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A TWENTIETH CENTURY ENTERPRISE.

Among the various enterprises which will inaugurate the new century none will be of more interest than the Pan-American Exposition, which is to be held at Buffalo, N. Y., next Summer. While the collection of specimens of the industry and examples of the progress of the various states of the two Americas will, in itself, be sufficiently interesting and furnishes a sufficient reason for such an exposition, still its principal feature, and the one that will doubtless attract the most attention, will be the over-shadowing importance of electricity and electrical application.

No achievement that has marked the wonderful nineteenth century—the hundred years that of all the years have marked the world's history will stand forth as the period in which civilization took the longest steps—has been so great or so compelling as the discovery of electrical application and the utilization of this agency for all the arts of peace and war. There will be gathered together at Buffalo next Summer certainly the most comprehensive collection of electrical apparatus and the most elaborate display of electrical activities in illumination, the production and transmission of motive power, the application of electricity to transportation and to all the innumerable uses for which it has proved so valuable, that has ever been seen anywhere. And the power of Niagara, twenty-seven miles away, will turn every wheel and illuminate every lamp. From present indications, the electrical exhibit at the Paris Exposition this year will be far exceeded, both in point of size and excellence, while the electrical illumination and decoration of the grounds and buildings will be upon a scale hitherto unapproached. The exhibits will be arranged to cover completely all the various departments, and it is urgently hoped that they will be as complete as it is possible to make them. Indeed, seeing that this is an American enterprise and that no country on the face of the earth is so identified with electrical advance as this, there seems almost no excuse for the manufacturer of electrical apparatus or products in this country not to exhibit and exhibit largely. A united effort will make the exposition entirely representative of that industry which, of all others, is most American and which, we may be pardoned for believing, is the most important in the country. No more fitting introduction to the great work that will be accomplished in the twentieth century can be imagined than the collocation of all that represents progress made in the nineteenth century as an illustration of the point to which the art is advanced—a point of departure for the labors of ensuing generations.

A NATIONAL STANDARDIZING LABORATORY.

Congressional action in the matter of a foundation of a standardizing laboratory in this country has progressed very slowly. A bill has gone through the committee stage in the House but owing to the early adjournment of Congress was not acted upon.

The whole of the electrical interests of the United States are interested in this matter and have already put themselves on record with strong expression concerning the importance and usefulness of such a laboratory. In the contemplated institution would be kept the standards of weights and measures, including electrical units and photometric units, and to it could be referred all sorts of secondary standards and from it would come authoritative statements concerning all matters relating to standard measurements of whatever kind. It would fill the place in this country that is occupied in Germany by the Reichsanstalt, an institution which has been of almost incalculable benefit to German manufacturers. More than any other single institution it would assist the universal adoption of the metric system by the English-speaking people. There can be no denial of its high value and great importance, and there seems absolutely no reason why any one should oppose its foundation. Without it we are in an anomalous position and are really dependent upon standards maintained and kept elsewhere. The cost of such an institution would be en-

tirely insignificant in comparison with the benefits that it would confer upon the electrical and mechanical industries, now of such vast and multiplying importance in the United States.

It seems, therefore, the duty of every manufacturer and every person interested in electrical and mechanical work in this country to impress upon his Senator or representative in Congress the urgent necessity for the passage of this bill at the earliest possible moment. Unless the matter is taken up at the forthcoming short session of Congress it will be delayed at least another year and possibly longer. Senators and representatives can not be urged too strongly to support this important measure and the matter is one that should be taken up and discussed by commercial bodies, boards of trade, scientific and engineering societies and in the technical and daily press until its extreme importance is made so evident to the members of Congress that they will use every effort to pass the bill promptly and to establish the laboratory under proper conditions and with a sufficient appropriation to make its work useful.

CARELESSNESS.

A press despatch of a few days ago gives an account of the death, by his own carelessness, of a switchboard attendant in a manufacturing establishment in Newark, N. J. It appears that the young man, either through carelessness or familiarity with his duties—the kind of familiarity that breeds contempt for high-tension current—failed to take the usual necessary precaution and was instantly killed. Of course, so far as he is concerned, he will have no further opportunity for carelessness, but if the accident could be used as a warning for others similarly employed, he would not have died in vain. There is nothing that demands more continuous and persistent carefulness than the handling of high-tension electricity. Even if apparatus on switchboards and such structures as dynamos and transformers is surrounded with every safety appliance known to the art there is always an opportunity for the meddlesome or careless person to be injured or killed by the current, which is no respecter of persons. After proper precautions have been taken by the owners of an electrical installation, electrical accidents are due generally to the fault of their victims. This fault is, nine times out of ten, the negative error of carelessness. The moral of the accident is twofold, in that it should teach not only the greatest possible care in the installation and protection of high-tension apparatus, but it should also point out to employees concerned with such machinery the constant danger that besets them if they forget or fail to concentrate all their mental faculties upon the subject in hand.

Few Americans realize how important will be the attitude of export manufacturers in this country during the next five years. As things stand at present there is a triangular contest between Great Britain, Germany and the United States for the export markets of the world. In this the Americans now have a decided advantage, while the British have fallen from first place to third place, and are at present having trouble in keeping hold of their own home markets against the pressure of foreign competition. Germany is straining every nerve to displace British goods with those of its own manufacture and has gone about the work with the intelligence and system that characterize that nation. But the United States, owing to the intelligence of its workingmen and to the inventive faculty which is constantly manifest in it and ever seeks to express itself in the construction of labor-saving devices, is well ahead in the race. While this gives us an excellent standing in the contest, our largest rival, Great Britain, is seriously handicapped by the tyranny of trades unions. What we need to do, then, to secure the prize that is offered us is to put forth our best goods and to win abroad the recognition that our goods are best and that they are honestly made as well as cheaply sold.

The modern passenger train, while complete with such auxiliaries as restaurant and dining cars, barber shops, bathrooms, libraries, smoking rooms and other appurtenances of comfort, still, on account of its peculiar form, lacks an essential element of convenience. Such trains are sometimes of a respectable fraction of a mile in length and when the passenger in the rear car wants to know if his turn in the barber shop in the front car is about due, or whether there is room for him in the dining car, he is compelled to take a long walk under somewhat disagreeable circumstances. A telephone exchange would certainly be a valuable addition on our long through express trains. There seems to be no insurmountable difficulty in installing telephones and some simple exchange system on such trains and thus giving the passengers communication with all of the auxiliary appliances of the train as well as with the conductor and other members of its personnel. While there may be some little difficulty in the working of transmitters on a vibrating train, there seems none that may not be overcome by a little experiment, while the value of such a system is indubitable.

It is curious that, in all the discussion of wireless telegraphy and the application that may be made of this agency, no one has yet suggested that a system independent of storms, requiring no conductors overhead liable to damage and interruption by weather conditions and no expense for installations underground, could be used with great success for fire-alarm telegraphs. Of course, it may be urged that the present state of the art of wireless telegraphy is such that it is hardly applicable for this purpose, but there is nothing for which its use has been suggested that is so important and valuable, and no application that would be easier to test under practical conditions than this. The idea is advanced simply for what it is worth and in the hope that it may produce some discussion which will result in practical benefit.

A correspondent inquires concerning the advisability of soaking carbon brushes for motors and dynamos in some lubricant. He relates that his experience has been that much better results are obtained when carbon brushes are soaked for a week or two in a moderately heavy oil, so that they will absorb it intimately into their pores. He contends that brushes thus treated are much superior to those that have not been oiled, and wishes to know the experience of others in the same connection. The ELECTRICAL REVIEW would be pleased to publish the results of such experience had by any of its readers.

THE THEORY OF ALTERNATING DYNAMO-ELECTRIC MECHANISMS—IV.

BY W. ELWELL GOLDSBOROUGH.

MAGNETIZATION CURVES.

On page 480 it was shown that the electro-motive force generated in the armature of an alternator is very nearly a pure sine function of the time. We will now consider what variations of the magnetization take place through one of the coils on such an armature to produce this form of electro-motive force. The electro-motive force induced in a coil of wire is proportional to the *rate of change* of the number of lines of force threading the coil, and a *decrease* in the number of lines of force threading a coil will produce an electro-motive force *opposite in sign* to the electro-motive force induced in the coil by an increase in the number of lines of force through the coil in the *same* direction. In the electro-motive-force curve, *rab*S*cdpef* of Fig. 16, the electro-motive force is constantly increasing from the point (*r*) to the point (*p*), therefore the number of lines of force that produce this electro-motive force must gradually increase in a positive direction from the time when the electro-motive force is (R*r*), to a maximum when the electro-motive force is zero at (S), and decrease in a positive direction again as the electro-motive force rises to a value (P*p*), since the electro-motive force changes sign at S. The magnetization is, therefore, always a *maximum* when the electro-motive force it induces is *zero*.

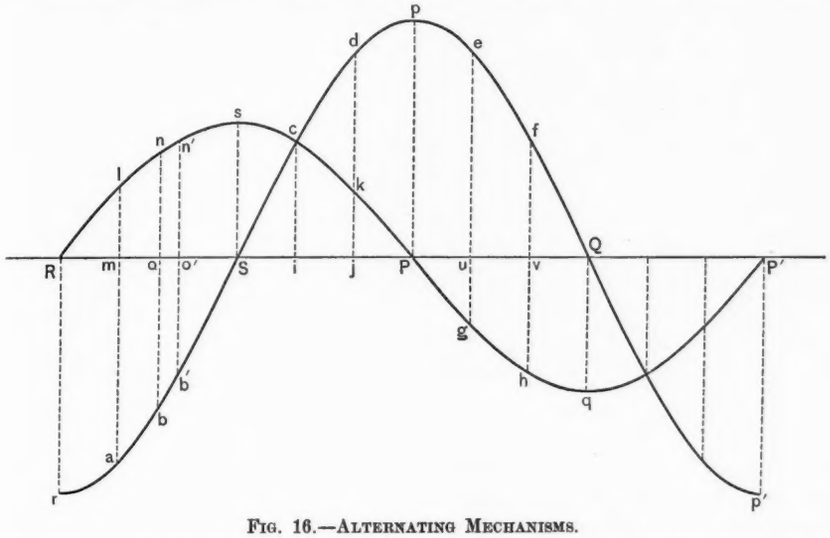

FIG. 16.—ALTERNATING MECHANISMS.

Moreover, since a *decrease* of the number of lines of force in one direction through a coil produces an electro-motive force of the same sign as is produced by an *increase* of the number of lines of force through the coil in the *opposite* direction, therefore half of the electro-motive force of the loop S*cdpef*Q must be produced by the *decrease* of the magnetization from a positive maximum at (S*s*) to zero, and the other half by an increase of the magnetism from zero (in a negative direction through the coil) to a negative maximum at (Q*q*), since as many lines of force are taken from the coil as are introduced into it when the direction of the lines of force through the coil is changed. The curve of magnetization therefore crosses the axis of (X) at the foot of the ordinate that bisects the area of the positive loop of the electro-motive-force curve, since the head of this ordinate determines the point that bisects the total induced electro-motive force of the positive loop.

This results from the increase or decrease in the magnetization during any interval of time, being proportional to the area of the electro-motive-force diagram developed within the interval of time. For, if, during the interval of time $o\,o' = (d\,t)$, we consider the magnetism to increase uniformly from a value $N = o\,n$ to a value $N' = o'\,n'$ the value of (e) (which is negative) during this infinitesimal period will be constant, and by Faraday's law,—

$$e = -\frac{\Phi' - \Phi}{d\,t} \qquad (31)$$

$$\therefore \quad e\,d\,t = \Phi' - \Phi \qquad (32)$$

therefore the area *moab* will be equal to the increment of increase in the number of lines of force threading the coil during this time.

By the addition of a successive number of increments it can in the same way be shown that the electro-motive-force area *ab*S*om* is equal to the increase in the number of lines of force threading the coil during the time $t = o$S (that is,—the area *ab*S*om* = S*s* − *o n*), and that any variation that takes place in the magnetization during any period of time is equal to the area of the electro-motive force curve that is developed in that time.

If, therefore, the line (P*p*) bisects the positive loop of the electro-motive-force curve, the area S*cdp*PS is equal to the number of lines of force represented by (S*s*), since during the time (SP), the magnetization decreases to *zero*, and the area P*pef*QP is equal to the number of lines of force represented by (Q*q*), since during the time (PQ) the magnetization increases from *zero* to (Q*q*) in a negative direction.

The development of these curves shows that the electro-motive force lags 90° behind the wave of magnetization that produces it, i. e., when the magnetization is a positive maximum the electro-motive force is changing from a negative to a positive value through zero, and when the magnetism is changing from a positive to a negative value through zero, the electro-motive force is a positive maximum, etc.

Mathematically these facts are expressed as follows, assuming (e) to be a pure sine function, by equation (3),

$$e = \mathrm{E} \sin \omega\, t,$$

and by equation (31),

$$= -\frac{\Phi' - \Phi}{d\,t} = -\frac{d\,\Phi}{d\,t}$$

therefore

$$d\,\Phi = -(\mathrm{E} \sin \omega\, t\, d\, t) \qquad (33)$$

and

$$\Phi = -\mathrm{E} \int \sin \omega\, t\, d\, t \qquad (34)$$

$$= \frac{\mathrm{E}}{\omega} \cos \omega\, t \qquad (35)$$

$$= \frac{\mathrm{E}}{2\,\pi\,\mathrm{N}} \sin (\omega\, t + 90°). \qquad (36)$$

From equation (35) it is evident that when $\cos \omega\, t = 1$, as at (S), Fig. 16, Φ will have attained its maximum value, therefore when (e) is a sine function,—

$\Phi_{max.} = \mathrm{E} \div 2\,\pi\,\mathrm{N}$ webers when E is expressed in c.g.s. units of electro-motive force.

and $= \mathrm{E} \times 10^8 \div 2\,\pi\,\mathrm{N}$ webers when E is expressed in volts.

Equation (36) shows that the wave of magnetization is 90° in advance of the electro-motive force it induces, as shown in Fig. 16.

To locate a curve of magnetization from a consideration of the curve of electro-motive force which it produces, whether the curve of electro-motive force be a sine curve or not, determine by means of a planimeter the ordinate that bisects the electro-motive-force curve. The foot of this ordinate determines the point at which the magnetism is zero.

To construct the magnetization curve on either side of (P) divide the electro-motive-force loop up by as many vertical lines as there are ordinates desired. Find the areas included between each of these ordinates and the bisecting line and lay off on each ordinate distances equal to the corresponding areas so determined, in directions such that the magnetization curve will fall in advance of the electro-motive-force curve.

(In Fig. 16,—ug = the area PpeuP, vb = the area P$pefvu$P, Qq = the area P$pefQvu$P, jk = the area PpdjP, ic = the area P$pdcij$P, and Ss = the area P$pdcSij$P.)

To determine the value of the maximum magnetization, Φ_m, when the ordinates of the electro-motive-force curve are expressed in volts, find the value of the maximum electro-motive force in volts (E), of the period (T) in seconds and of the area (A) of the half of one loop of the electro-motive-force curve. To maintain a constant electro-motive force (E) at the terminals of an armature for T ÷ 2 seconds would require a uniform variation of the field strength from zero to a maximum of

$(E \times T \times 10^8) \div (C \times 2) = \Phi_1$ webers

during this time, if (C) be the number of active conductors in each armature coil and all of the armature coils are connected in series as is usual; therefore the area (A_1) of a parallelogram having a base equal to one-half the period of the curve and its altitude equal to the maximum ordinate of the electro-motive-force curve will represent this magnetization N_1.

Then by a simple proportion,—

$$\Phi_m = \frac{A \times \Phi_1}{A_1} = \frac{A \times E \times T \times 10^8}{A_1 \times C \times 2}$$

The Chambly Dam Broken.

The great concrete dam at Chambly, Quebec, damming the waters of the Richelieu River and furnishing a source of power for numerous woolen mills as well as for the electric transmission line which delivers some 10,000 horse-power to Montreal, was swept away on the night of November 16, 15 sluices being completely demolished. While considerable damage was done to the woolen mills below the dam, it is not stated in the press despatches covering the accident that the electrical machinery suffered at all. The dam was the largest concrete dam in North America and was built in the shape of a letter Z, the power house being integral with the lower part of the dam and in general greatly resembling the structures at Mechanicville and Massena, N. Y.

Science Brevities

Becquerel Rays—Herr M. Maier describes, in a German contemporary, a particularly active radium preparation obtained by Giesel. His results are thus abstracted by Mr. Fournier d'Albe: It shows a clear white spontaneous luminescence. On a highly sensitive bromide plate its rays produce a strong impression in 30 seconds, while the ordinary pitchblende requires an hour for the same amount of action. The rays are capable of penetrating an iron plate four millimetres thick and a layer of mercury 20 millimetres thick and yet producing an impression in four minutes. The substance has shown no measurable diminution of radio-activity in the last eight months. The author has found that the magnetic deflection of the rays is very sensibly diminished by placing the substance in a vacuum. Efforts to obtain evidence of refraction and regular reflection failed. Special attention was paid to diffraction and interference. The rays were sent through a slit one millimetre wide, formed by very thick steel plates, and had further to traverse a slit 0.05 millimetre wide. But no diffraction was observed, thus confirming Becquerel's negative results. Equally unsuccessful was the attempt to produce polarization by means of tourmaline. But all bodies appear to produce diffused reflection of Becquerel rays, and some bodies, like ebonite, aluminum, lead and iron, acquire a secondary radio-activity on prolonged exposure, which disappears, however, in a short time.

Neutral Point of Thermo Couples—An *Electrician* note says: Herr A. Abt describes a simple method of determining the neutral point in thermo couples which is specially suited to demonstration purposes. It is based upon the equation

$$E=(t_1-t_2)[a+b(t_1+t_2)].$$

The temperatures of the junctions are changed until the current disappears. When that occurs, the neutral point is the arithmetical mean of the temperatures t_1 and t_2 of the junctions respectively. The arrangement as described consists of two wooden frames with openings closed by plates of asbestos, one on each face of the frame. Holes are bored in the plate, and thick steel rods are inserted through the holes. One end of each rod contains receptacles for the bulb of a thermometer and for one junction of the thermo couple, while the other is heated by a Bunsen flame. Images of the thermometers and of the galvanometer scale are thrown upon a screen, and the heating is carried on until the current disappears, or until it reaches a maximum, while one junction is kept at the temperature of the room. The neutral point is 117 degrees in a brass-lead couple, 276.8 degrees in an iron-silver couple, and 232 degrees in an iron-zinc couple.

An Electric Power-House Fire.

The Huntersville power station and car sheds of the Norfolk, Va., Railway and Light Company, were totally destroyed by fire on November 11. The fire started in one of the cars, and spread so rapidly that only 11 of the 62 cars in the sheds were saved. The fire department did good work, but as the supply of water was very limited, no more could be done than to save surrounding property and keep the fire from spreading to the buildings of the Standard Oil Company adjoining. Car service on the more important lines was resumed within a few hours at intervals of 10 or 12 minutes, current being supplied from the Cove street power-house of the company. Orders were immediately placed for new cars, and it is expected that within two weeks the service will be restored to its usual efficiency. The loss is estimated at $150,000, fully covered by insurance.

A Cuban Development Syndicate.

Among recent incorporations of interest to electrical men is that of the Cuba Company, a new commercial enterprise said to be organized by leading business men of the country for the purpose of developing a railroad and kindred industries, which include the erection, equipment and operation of electric light plants throughout the island. The capital of the company is $8,000,000 and the charter has been granted under New Jersey laws, the full amount of the stock having been subscribed. Sir William C. Van Horne, of Montreal, Canada, has already sailed for the island with the view of investigating matters there and reporting definitely what the policy of the company should be.

Somewhat contradictory reports have been received regarding the amount of the capitalization, the figures ranging all the way from six to twenty million dollars, but it is believed that $8,000,000 is the correct figure. Among the prominent stockholders of the company are said to be Levi P. Morton, William C. Whitney, P. A. B. Widener, H. P. Whitney, of New York, Philadelphia and Boston, and Sir William C. Van Horne and Dr. L. W. Shepard, of Montreal, Canada.

A TYPICAL SMALL ELECTRIC LIGHTING PLANT.

THE STATION OF THE IOWA CITY, IOWA, ELECTRIC LIGHT COMPANY.

Scattered throughout the United States are many hundreds of small electric light stations, each of which has its own problems to encounter and has adapted itself to local conditions, with more or less success, carrying out in a way, while less conspicuous no less interesting than that exhibited in the larger stations, the application of electrical engineering to the distribution of current for public use.

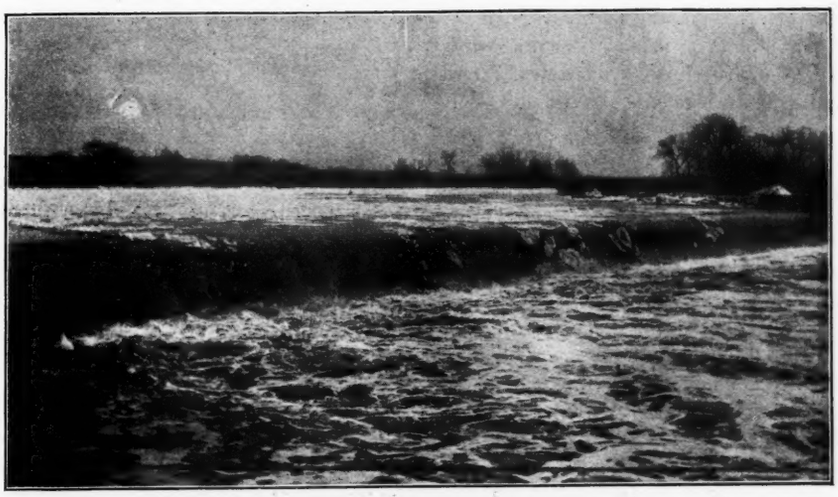

FIG. 1.—DAM ON IOWA RIVER FOR IOWA CITY ELECTRIC LIGHT STATION.

For several reasons the plant of the Iowa City, Iowa, Electric Light Company is of interest; in fact, it is typical of stations in small towns and also is entirely modern in its equipment. The plant was installed in the Summer of 1899, and is a combination plant, or one depending upon water power, with a steam auxiliary which is used at certain seasons of the year or in times of extreme load to help out the water-wheels.

The station is situated about two miles from the town on the banks of the Iowa River, which is dammed at that point, the dam being 300 feet wide between abutments and high enough to get about 10 feet fall at the turbines. It is well shown in Fig. 1, which exhibits ice coming over the dam at the break-up of the ice in the river in the Spring. At one end of the dam is erected a brick building, one story high and 90 feet square, having concrete floors and an unusually high ceiling. The structure is well lighted and ventilated and is heated by steam. Along the side of the building, next the river, runs a line shaft 65 feet long, to the centre of which is connected by means of bevel-gearing a large water-wheel, while a smaller wheel is similarly connected at one end and the engine used as a steam auxiliary is belted to the other end. Near the large wheel at the middle of the shaft is a quill, so that part of the machinery can be run by one wheel alone or all of it by the two together or the engine as may be desired. At present, for example, the commercial alternating circuit is in use at least one hour before the street lighting arc lamps are required. Hence the large water-wheel driving the alternating-current dynamo for general lighting is started up first and the small wheel is coupled with it in order to run both the incandescent and arc dynamos when the street lighting circuit is required. The line shaft runs at 250 revolutions per minute. It was installed by the Hill Clutch Company, of Cleveland, Ohio.

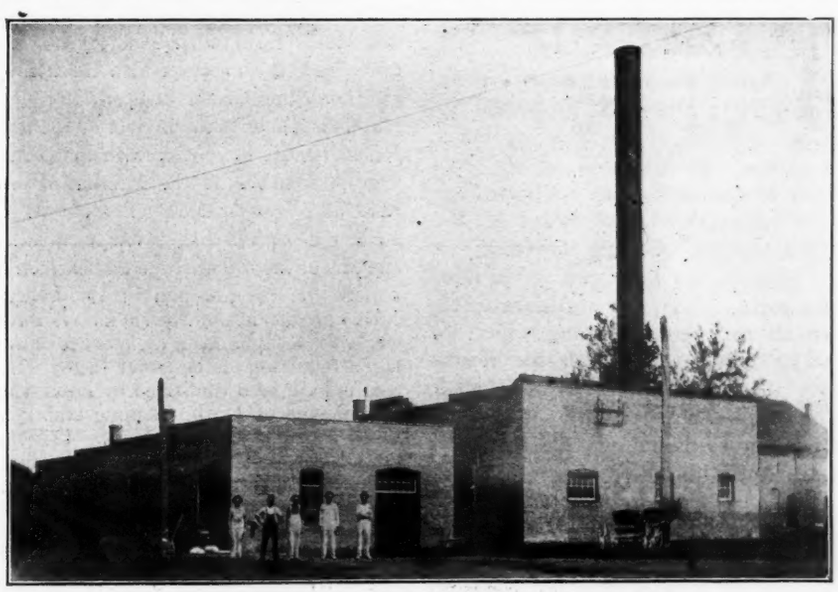

FIG. 2.—EXTERIOR VIEW OF IOWA CITY ELECTRIC LIGHT STATION.

The water-wheels are of the "Samson" pattern, made by James Leffel & Company, Springfield, Ohio. The larger wheel is 62 inches in diameter and runs at 80 revolutions, and the smaller is of 50 inches diameter, running at 100 revolutions; the capacities of the two wheels are 240 and 150 horse-power, respectively. A Woodward compensating-type governor is attached to the wheels, which are also provided with hand gearing for hand regulation.

About two months out of every year, when the water in the river is low, the engine is required to help out, and for this purpose there has been installed a high-speed single-cylinder engine, 21 by 20 inches, running 200 revolutions per minute, made by A. L. Ide & Sons, Springfield, Ill. In one corner of the building is the boiler room, which is provided with two locomotive boilers, six by eighteen feet, each having 70 four-inch tubes; two feed-pumps are provided, one of the Dean Brothers make, and the other built by the George F. Blake Manufacturing Company, of Boston. The smokestack is of steel, 95 feet high from the grate and five feet inside diameter. A feed-water heater of the Baragwanath pattern is used in connection with the boiler, and a condenser, made by the Dean Company, of Holyoke, Mass., outside the boiler room, permits the engine to be run condensing when desired.

The electrical equipment of the station consists of two Wood arc machines, each of 80 lamps (9.6 amperes) and one Stanley two-phase alternator, giving 195 kilowatts at 60 cycles and 2,400 volts. In the middle of the room is a marble switchboard equipped with the usual appliances

and in addition with a static ground detector and a static voltmeter reading to 3,000 volts.

Alternating current is transmitted two and one-half miles to the centre of distribution in the town over three No. 1 copper line wires, the total loss at full load being about two and one-half per cent. Within the city four wires are used and it is claimed that little trouble is found in keeping the circuits balanced. In stores and shops the lights furnished private consumers are mainly enclosed alternating arc lamps, while the street lighting circuit carries about 120 open-arc direct-current lamps of 2,000 nominal candle-power each. At the point where the wires leave the plant Wurts lightning arresters are installed on an insulated oak frame which also carries the totalizing wattmeters for recording the output of the plant. Over the transmission line, through its whole length, is stretched a strand of barbed fence-wire as a protection from lightning, this wire being grounded occasionally. Although thunder-storms are numerous and severe in central Iowa, there has not been any accident due to lightning at this plant. The accompanying illustrations give excellent ideas of the interior and exterior of this small but typical installation.

An Important Decision on the Franchise Tax Law.

A decision was handed down on November 14 in Albany, N. Y., by the Appellate Division of the Supreme Court, in proceedings instituted by the New York & Queens County Railway Company against the State Board of Tax Commissioners, attacking the validity of the franchise tax act regarding the filing of reports. Under the provisions of the law all corporations coming under the special franchise act shall file reports with the Board before October, 1899. This rule was not observed by the railway company, which did not file its report until April last, and afterwards instituted proceedings to review the valuation placed upon its property by the State Board. The commissioners contested the suit on the ground that the company, having failed to comply with the law, had no right to bring certiorari proceedings. The same view was held by Justice Herrick, who quashed the proceedings which finding the Appellate Court has now reversed.

This decision is one which applies to all electric companies now doing business in this state and coming under the special franchise.

THE PROGRESS OF ELECTRIC LAMPS.*

BY PROFESSOR ANDRÉ BLONDEL.

After passing in review the history and present applications of electric lighting, the author takes up the progress of arc lamps, first as to theory of the electric arc. Although its true nature is unknown, our knowledge of the phenomena has considerably increased. M. Violle has found that the temperature reaches 3,500 degrees centigrade for the positive and 2,700 degrees for the negative carbon. After several years' discussion it seems now established that there exists not a counter electro-motive force, but merely a resistance to the current. A simple law for uniting the different elements has been searched for; Mrs. Ayrton solved this problem for the first time, showing that the energy consumed was a linear function for every diameter of carbon and giving curves for the conditions of production of long and short arcs. The apparent resistance of the arc varies not only with the diameter of carbons and length of arc, but with the nature of the carbons and the gases in which they are placed, as has been shown by S. P. Thompson, Ayrton, Marks and others. He speaks of different experiments made upon the arc by Wilson, Cailletet, etc. The most unexpected effect of the surrounding medium is that which Mrs. Ayrton has discovered in connection with the hissing arc; according to her analysis, this phenomenon is due to the arrival of the oxygen of the air in contact with the crater. The phenomena of the alternating arc have also been studied. From 1891 to 1893 the author has given a detailed analysis of the illumination and extinction periods of the arcs and of its periodic curves of current and electro-motive force, whose form explains, in the absence of any lag, a reduction of the power factor. His results have been confirmed by interesting experiments of Frith, Fleming and Pentavel, Burnie and Rodgers, etc. It seems established that the electro-motive force curve and the self-induction in circuit can modify the relation between the effective electro-motive force and the effective current, but that the effect of self-induction is preponderant; the latter increases the stability, but decreases the power factor. In practice all the curves are rounded on account of the influence of the conducting core used, permitting power factors near unity to be obtained.

Stability of the electric arc and method of regulation of lamps—The electric arc does not follow Ohm's law, as an increase of current causes an increase of arc section and thus a lowering of resistance, giving a tendency toward an unstable regime and the arc would soon be extinguished if special precautions were not taken, especially in constant potential distribution, by the addition of a resistance in series. The author showed in 1891 how the conditions of stability could be studied by tracing a *characteristic curve of extinction* of the arc; that is, the curve of tension in function of the intensity of current when the latter is varied; the curves, obtained by two oscillographs crossed, resemble those of Mrs. Ayrton.

As to method of regulation, everybody is more or less in accord in recognizing the superiority of the differential system which regulates at constant resistance. While a lamp in simple derivation requires a loss of 30 per cent of its tension in an outside resistance, the differential lamp requires but 15 per cent. These figures depend also upon the number of lamps in series. The alternating lamp takes a less resistance on account of the great sensitiveness of its mechanism under the influence of vibrations. He compares the supplementary fall of potential in the two lamps. Nevertheless, lamps in simple derivation present some decided advantages; they are more simple, do not risk being burned by a heavy current; their regime is more easily modified within wide limits, which is not possible with differential lamps.

Construction of arc lamps—The arc lamp presents great difficulties of construction, for it should be as precise and as durable as possible. It is exposed to variations of temperature and humidity, condensations of vapor, oxydation, dust, etc., and is often placed in inexperienced hands; repairs are to be easy and rapid. Thus all the best lamps have gained their reputation only by a great simplicity of parts. In the United States these qualities have, up to the present, appeared sufficient. In Europe, besides, an absolute fixity of the light is demanded, due to a perfectly continuous working of the mechanism and to an excellent quality of the carbons, and it is improbable that this idea will be abandoned. It is due to these exigencies that such a great perfection in construction has been reached.

For a long time mechanisms without clock-work have been sought for, such is the Brush, Pilsen, Borden, etc., to cite only a few. But in the most recent lamps a return to clock-work movements with escapement has been remarked, no doubt on account of their greater sensitiveness and their small consumption of energy. Motor lamps, for direct current, are scarcely employed except in projectors; but for alternating lamps, regulators with non-synchronous motors or simple disks meet with success. The mechanism of alternating lamps present special difficulties, on account of the effects of self-induction.

Lamps with two pairs of carbons—Lamps of this kind have now been perfected; they work, not alternatively, as in the old forms, but successively, so as to double the duration of working, or to reduce the diameter of the carbons, thus in-

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creasing the luminous effect. The best of these, Crompton-Pochin, Brockie-Pell, have long been used in England; the Roumazellas lamp, in France; the Körting and Mathiesen, in Germany, etc. The author recommends these lamps for the best utilization of energy. Other advantages are the reduction of hand work, waste carbons, etc.

Grouping of arc lamps—The use of isolated arcs is the exception at the present time. Three systems are now used: The old system of two lamps and a resistance on 110 volts, the latter absorbing one-

FIGS. 3 AND 4.—INTERIOR OF IOWA CITY ELECTRIC LIGHT STATION—(See Page 541).

third the voltage. In recent years, two opposing tendencies have been manifested: One, due to Mr. Marks, is the use of high-voltage enclosed arcs at 110 volts; the other, the grouping of the lamps three in series, each taking 30-35 volts.

Low-voltage lamps—From 1897, the Volta lamp brought this idea into practice; it is now widely expanded. Several dispositions are used; Siemens & Halske, Körting & Mathiesen, etc., add to the differentiated lamps a rheostat by which a great resistance is put in for lighting, which is afterwards decreased. Once working, the lamps, with special carbons, continue well, but it is feared that by the sticking of any one of them a dangerous current may be produced. M. Hegner, in the Volta lamp, endeavors to avoid this inconvenience. His differential lamps, with special carbons, have no special mechanism, but each series of three have an automatic rheostat with four points; all the sections are put in at lighting, and are taken out successively when working. The short circuiting of the lamp is without danger and stability is assured. More recently, Messrs. Vigreux and Boillé have designed a mechanism suppressing the rheostat; the regulation is by differential system and brake. The superiority of these lamps over the old type is a disputed point. M. Blondel points out the advantages and disadvantages of these systems.

Series arc lighting—While extensively used in the United States, it has been almost entirely abandoned in Europe, only one new application may be mentioned—the Ferranti series system with rectified currents, used with success in England in several cities having alternating stations; it permits the use of lamps of higher efficiency than alternating lamps with the current of the station; but the current, rendered pulsatory, is as dangerous as the alternating current, and thus it is not used on the continent, where it is preferred to make the transformation to direct current by rotary converters, or to use alternating arcs with reflectors.

Lamps with enclosed arcs—It is only in 1894 that the modern type appeared, which is characterized by the use of a very long arc working at 75-80 volts in a chamber imperfectly closed. The Marks or Jandus lamp is described, and the advantages of enclosed arcs pointed out; the system is extensively used in America; an alternating system is used at Hartford; unfortunately, the efficiency of these arcs does not justify the solution employed.

Carbons—The perfection of carbons keeps pace with that of the mechanism. The European carbons are made from gas carbon well selected, separated by hand from silicious matter, and mixed in variable proportions with lampblack, tar and certain chemical substances added to increase the life or luminous effect. The paste, reduced to powder and purified, is, after working, formed under pressure and baked at the highest temperature possible; it is often impregnated with boric acid. All the European makers add to the positive carbon a core composed of carbon mixed with silicates or borates, which give off conducting vapors favorable to the conductability and stability of the arc. It is due to the core that the hissing point has been lowered below 35 volts and a stable arc realized between widely varying voltages; this core is the secret of the good working of modern lamps. The price of carbons is only one-tenth of what it was 10 years ago. European carbons are greatly used in the United States, but for American consumption only inferior carbons are made; these carbons, which are homogeneous but little conducting, answer well for lamps of long duration with long arc, but for low-tension lamps they must be coppered; this process is now abandoned in Europe except in special cases. The author has searched in vain for a good criterium for recognizing the qualities of carbons according to their physical properties, molecular structure or chemical analysis. He can only say that the usual types present the following data: Apparent density, 1.30 to 1.35; real density, 1.50 to 1.85; specific resistance, from 0.005 to 0.01 ohm-centimetres, generally near 0.008 to 0.0095. The cores contain generally 80 to 85 per cent carbon, 5 to 6 per cent water and the rest in silicates or borates. Outside of resistance measurement, the best method is to test the carbons by actually burning and make the necessary observations.

In alternating lamps, two special carbons are generally used, both with strongly mineralized cores, allowing a lowering of voltage. Schiff, Jordan & Company and Siemens Brothers first succeeded in lowering below 25 volts, but the tests of M. Jigouzo show that the best efficiency is obtained in placing a homogeneous carbon below.

Utilization of the electric arc—Reflectors and globes—The protecting reflector placed above and near the carbons is now in general use in alternating lamps, enabling them to compete to less disadvantage with direct-current lamps. Certain firms, as the Allgemeine Company, use it even for the latter type. The increase of mean hemispherical intensity reaches 10 per cent in direct and 50 per cent for alternating-current lamps. Opaline globes absorb now 15 to 25 per cent. The

Holophane Glass Company's globes solve the problem satisfactorily. Shops and offices are now lighted to advantage by bottom reflectors sending the light to the ceiling. Lamps with inclined carbons, of the Soleil type, seem now abandoned, but appear to have been recently taken up by M. Bremer with more or less success.

Photometry of arc lamps—The photometric definition has given confusion, as four different intensities are considered; namely, horizontal, mean spherical, maximum and hemispherical intensity, without counting the so-called *nominal* intensity. The curve of distribution of light in a meridian plan should be traced; this is best done by a mirror at 45 degrees mounted on an axis; the system has been perfected by the author and by Messrs. Wedding and Laporte; a well-designed apparatus is seen at the Central Laboratory, of Paris. The Matthews method, of America, is another improvement, making curves automatically upon a cylinder with great rapidity. The work has been shortened by the *lumen-meter* devised by the author, which only one reading is taken of two opposite beams of the sphere, these being then compared with previous date. The results or different experimenters are difficult to compare; the arc should be defined not only by the current and tension at the terminals, but the diameter of carbons, tension between points and length of arc (when possible) should be given, also the kind of core used. It is desirable that in every country experimenters should be in accord in registering their results; the voltage should be taken between the points to eliminate the variable resistance of the carbons; as standards of light may differ, a common standard should be adopted. The problem of photometry is one which is very complex and presents numerous difficulties, most of which are little known.

Luminous efficiency of arc lamps—As in the case of luminous intensity, it is necessary, to avoid confusion, to specify whether the efficiency is spherical or hemispherical; mean spherical or hemispherical intensity is often used. For open spaces the latter is evidently the only one of interest, but for interiors with white ceilings, the former should be used. This efficiency depends upon three main elements: The electro-motive force between the carbons, length of arc and diameter of carbons. The first two depend upon the quality of the core and the last upon the duration of lighting desired compared with the consumption of carbons. Numerous experiments have failed to give exact data upon the subject. The author describes a series of curves he has obtained, showing that the efficiency is increased by a reduction in diameter of the carbons; it increases with the tension to a maximum depending on the current, then decreases. This maximum varied from 10 to 25 lumens, or 0.8 to 2 (Hefner) candles, mean spherical, per watt for continuous, or from 0.4 to 1.40 candles, spherical, for alternating current. In another series of experiments not yet published, continuous and alternating arcs have been compared in their practical conditions of use; calling I the mean spherical intensity in Hefner candles and W the power in watts, between 300 and 1,500 watts, the following formulæ were obtained:

Direct current $I = 1.75\ W$

Alternating current $I = 0.9\ W$

The last figure may be made better by increasing the voltage. This subject will be again brought before the congress in detail, it shows the inferiority of alternating currents, already brought out by Fleming and Petavel and other experimenters.

According to other experiments, notably those of Wedding, the hemispherical luminous efficiency of lamps with reflectors with normal carbons and their coils in shunt, increases with the power, very rapidly below 200 watts (below which it is not wise to descend), then more slowly. With a reflector of a well-known type, the hemispherical luminous effect I′ is a linear function of the power W.

$$L = 1.4\ W - 102.$$

If it is considered that the reflector increases generally the mean spherical intensity by 50 per cent, these figures agree fairly well with those given above. By comparing these results with those of Voit and Wedding for continuous-current lamps, it is found that the consumption per Hefner candle of hemispherical intensity is about 1.1 watts for alternating lamps of 200 watts or continuous of 60 watts, and 0.68 watt for alternating lamps of 1,100 watts or continuous of 150 watts; between these limits the ratio of consumption for equal power varies from 2 to 1.5, that is to say, the efficiency (hemispherical) of the alternating arc lamp varies in relation to that of the continuous-current lamp of the same power from one-half to unity in ordinary cases. This difference is partially compensated by the suppression of the rheostat, replaced by a self-induction coil, but it appears to a full extent when three direct-current lamps are placed in series without rheostat.

Concerning arc lamps of low voltage, they owe a great part of their success to the use of special carbons, as mentioned above. By increasing the proportion of mineral salts in the core the voltage may be reduced at will, but with detriment to the luminous efficiency. The measurements cited by the partisans of these lamps, making their efficiency superior to ordinary arcs with good carbons of the same diameter, may be regarded as incorrect.

The photometric study of the enclosed arc has been made by several experimenters. The globe used absorbs 30 to 40 per cent, making the efficiency rather low. Tests of a Marks lamp in 1897 showed that in a 4.5-ampere lamp, with 12-millimetre carbons, the consumption was 1.17 watts per candle or 1.6 with rheostat. The efficiency of an enclosed arc is about two-thirds that of a good free arc of the same power. After giving some other measurements the author concludes that the efficiency of an enclosed arc is much less than that of the open arc. However, the enclosed arc, although notably inferior to the open arc, is superior to the incandescent lamp, and its great practical advantages make it often preferable to the free arc. In the United States, where hand work is simplified and economy of carbons is desired, this form has rapidly taken precedence. For the enclosed alternating arc, according to recent tests, its efficiency is still lower. The consumption is 3 to 4.35 watts per candle-power at the lamp terminals, instead of two watts for the enclosed arc with direct current.

PROGRESS OF INCANDESCENT LAMPS.

The incandescent lamp continues to progress from the standpoint of regularity of manufacture, efficiency, life and cost; numerous attempts have been made to modify its principle, but it is only of late that encouraging results have been attained. Lamps with carbon filaments will be first considered, then the new types.

Lamps with carbon filaments—These lamps are the only ones in general use; they are made from 8 to 36 candles, and exceptionally at 50 and 100 candles, with three to five for small lamps. Although their yellowish color may be objected to, but the composition of their light is much more favorable to vision, as it is rich in yellow rays, which give the maximum of visual sharpness, while the more refrangible rays, fatiguing to the eye, are absent.

Progress of the theory—Different experimenters have studied the temperature of the filament, with interesting results. Professor Weber considers that the temperature is 1,565 degrees to 1,568 degrees centigrade. M. Le Chatelier, by the aid of his optical pyrometer, has found a higher figure, 1,800 degrees centigrade at a decrease of resistance of 49 per cent. M. Janet, by more precise measurements, based upon the cooling of the filament, finds 1,610 degrees to 1,720 degrees for 16 candle-power lamps of 65 volts.

The idea usually admitted as to the variation of the filament with the temperature does not always hold good. M. Anthony in 1887 observed in certain lamps a change of sign of the temperature coefficient; lately, Mr. Howell, by a systematic study, has shown that the core of the filaments decreases in resistance with increase of temperature, but the deposited carbon, on the contrary, acts like pure graphite and increases in resistance. According to the proportions of core and deposited carbon, the filaments may present variations in opposite sense, or even *nil*.

Progress of manufacture—As a whole the methods of manufacture have not changed essentially in 10 years, but improvements in details and competition have caused a considerable amelioration. A good 16 candle-power lamp (110 volts), which in 1889 cost three francs, sells now in France for 0.5 franc; its vacuum is better, the filament more solid and durable, with increased efficiency. At present, lamps with very fine filaments, perfectly homogeneous and uniform are made by the use of dissolved cellulose, formed under pressure. These processes analogous

to those of artificial silk, with numerous variations, have now almost entirely replaced the others, even those of Edison and Swan, for ordinary filaments. These filaments are sufficiently homogeneous not to need a deposit of carbon, but this is necessary for another reason; the carbon deposited at a high temperature gives a coating more dense and less easily disassociated; the blackening of the bulb is thus lessened; by its means, also, the resistance may be modified, as the deposited carbon has 8 or 10 times the conductibility.

The production of the vacuum has been greatly perfected by using powerful mercury pumps, using mechanical pumps for the first vacuum. In certain cases, the final vacuum is made by chemical means, gaseous hydrocarbons are introduced, and, after exhaustion, the remainder is absorbed by heating a chemical substance of secret composition (with phosphorous as a base, according to reports) previously placed in the bulb; the vapors are absorbed, removing all trace of air and the vacuum is better and more rapid (two minutes instead of 10 to 15) than with the mercury pump.

The soldering of the carbons to the wires, formerly obtained by the precipitation of carbon in a liquid hydrocarbon, are now made, more economically but less solidly, by a paste of carbon and tar carried to a high temperature in an oven. The attaching wires are of nickel or ferronickel; different process, especially the use of ferro-nickel with 45 per cent nickel, conducting enamels, etc., have been used for supressing the platinum which traverses the glass, but in general this length is simply reduced to a minimum. The price of a 16 candle-power lamp is lowered to 0.50 franc, with 0.05 franc for the bulb and the same for the platinum. The renewing of lamps seems but little profitable. In spite of the small consumption of platinum, as it is not recovered, 2,500 kilograms of platinum are lost each year, valuing more than 6,000,000 francs, and this metal will soon become scarce.

Sockets and bases—The most complicated types have been eliminated, and the Edison and Swan are the only ones in general use. The bulb is sealed in the metallic cap by plaster. This material, easy of adaption, but little solid and swelling when dry, also hygroscopic, has been reduced to a minimum. It has been suppressed in the interval between the attachment to avoid electrolysis and short circuit. On this account, bases with metallic sealing have been tried, but these, while ingenious, have not come into general use on account of the extra handwork required.

Luminous efficiency—In this direction the least progress has been made. It is generally determined by the use of the maximum horizontal intensity. The manufacturers have announced excellent results, but these are generally obtained by using accumulators. In practice, upon city mains, the mean consumption of 3.5 watts per decimal candle can scarcely be lowered (the Hefner candle is only 0.88 of the decimal candle), for in these conditions a variation of 10 per cent in voltage raises the candle-power to 20 and the efficiency is raised to 2.6, with destruction of the lamp. The ordinary lamps rapidly lower in intensity on city mains.

High-tension filaments—The normal tension of 100 to 120 volts has long been considered a maximum; but, within a few years, an attempt has been made, especially in England, to use a double tension, 220 volts, so as to increase the capacity of existing systems. Several German stations and some in France have tried this solution. Double lamps or double filaments have been used, then lamps with a single filament, very fine, with several turns, working directly on 220 volts. The success thus obtained is disputable, for, although the graphitic deposit is relatively thicker, these filaments, very long and fine, are but little solid mechanically, not allowing as high a temperature as is desirable for high efficiency. After pointing out other defects in this sytem, M. Blondel considers that the true solution of these lamps, and *a portion* of 550-volt lamps, whose production is very desirable, should be looked for in the use of filaments of greater resistance than the ordinary filament.

Filaments in material other than carbon—The disadvantages of carbon filaments are their too easy volatilization and too great specific conductivity. Other substances, carbide of boron, carborundum, etc., have been tried; also mixtures of carbon powder with other bodies such as boron, silicon, refractory oxides, etc. Langhaus has tried, without success, to cover a core of oxides with a deposit of boron or silicon by treating. The only two processes now used in the industry are those due to Langhaus and Maxim. The former consists in a filament of dissolved cellulose, forced under pressure with the addition of powdered boron or silicon, then calcined in the electric furnace. The second (Maxim) consists in a filament formed of powdered carbon, crystallized, very hard, refractory and electrically resistant, obtained by a special process of precipitation, agglomerated by coal tar, then forced under pressure. According to the makers, these lamps blacken more slowly and the efficiency is increased 25 per cent. It is too soon to speak of them with more precision. The same is true for the osmium filaments of M. Auer von Welsbach, which have been talked about for several months, but which have not yet appeared in public; these filaments are obtained in different ways, especially by treating a platinum wire in an atmosphere of carbon, water vapor and osmic anlydride; the osmium filament, freed from the platinum support, is placed in a vacuum and carried to a higher temperature than is used for carbon filaments; it seems that a double efficiency is obtained. A disadvantage is found in the high price of manufacture and the great conductivity of the substance, allowing only 20 or 30-volt lamps to be used.

Filaments with oxides of rare earths as a base—It is of importance to know the true cause of the remarkable efficiency of these oxides. Some writers have considered it due either to luminescence, an exceptional emissive power, a high temperature (2,000 degrees) or a catalytic effect due to the presence of a small quantity of oxide cerium on the surface, but the experiments of Le Chatelier and Boudouard have overthrown these hypotheses, and show that it is simply a question of colored bodies which have a more favorable law of radiation than black bodies at the same temperature; the energy radiated per unit of surface is less, but being nearer the blue, its composition is better. Numerous experimenters have tried to coat carbon with these oxides, but the difference of expansion coefficient has rendered them unsuccessful. M. von Welsbach announces a filament of oxide of thorium formed by deposition on a platinum wire. Another series of filaments consists in a mixture of oxides and conducting body (carbon, iridium, osmium, etc.), but these are more or less unstable at high temperatures. M. Blondel then considers the Nernst lamp as now manufactured by the Allgemeine Company, of Berlin; this is shown at the exposition. Automatic illumination is obtained by a platinum spiral close to the filament. This lamp is said to be in use on a lighting circuit at Göttingen, Germany. The lamp gives a fine white light, consuming 1.75 watts per candle-power for 25 candle-power or 1 watt for 100 candle-power. The life is not yet determined, but it is to be feared that the filament is fragile and sensitive to variations of voltage. Official experiments and tests on lighting mains are necessary to establish its value, but if it fulfills its promises, a brilliant future is predicted. Mr. Blondel then considered the subject of standardizing of incandescent lamps at considerable length, as well as the different photometric methods used, and recommends that the congress adopt a provisory standard for luminous measures.

Hat-Telegrapher Gets Judgment.

A decision in the Supreme Court of New York recently awarded $5,000 damages for alleged assault and false arrest to Joseph W. Frost, of Brooklyn, against Robert A. Pinkerton and the Brooklyn Jockey Club. It was stated that a Pinkerton detective, acting on behalf of the Jockey Club, saw Frost and other men using a novel system for furnishing racing information to poolrooms by means of outside parties. It was also charged that a man named Pearsall, a confederate of Frost, wore a high hat in which were electric lights connected by wires with an instrument in the carriage. This was operated by Frost, the messages being received by confederates outside of the track, who got the information thus transmitted and telegraphed it to the poolrooms in New York. How much truth there is in this report is not known, as Frost's trial is at the present time in abeyance, his case not yet having been brought up.

TELEPHONE PAY SYSTEMS; FIXED RENTALS AND MEASURED SERVICE OR TOLLS—II.

BY C. E. McCLUER.

The calculagraph, now so generally relied upon for keeping records of toll-line connections, is an ingenious device, and, manipulated by an expert and careful operator, makes a clean and reliable record of time consumed in a telephonic conversation, but it is no more reliable as a means of tallying connections from measured service stations than the old-time pencil and pad. It moreover does not exclude the personal equation of the operator or atone for the fact that the customer is not present to witness its manipulation and satisfy himself that it is being made to keep correct tally.

A connection meter to be acceptable to the toll or measured-service customer must be automatic in its action, and should be located where it will be under his continuous observation. To be equally acceptable to the telephone company, it must be so designed that it can not be improperly manipulated or "beaten" by the user. Such mechanical counters as are used to tally the revolutions of a steamer's shaft, or the fares collected by a street-car conductor, or any device that would require the elective cooperation of the customer, are entirely out of the question. An automatic meter or counter employing cogs or pinions, or levers or ratchets, and operative for "out" calls only, to be actuated by the user whether he wills it or not, would be complicated, unreliable and expensive.

In the ELECTRICAL REVIEW of January 24, 1891, can be found an illustrated description of an automatic toll box and connection register that was devised in conformity with the views expressed above. It is simple, reliable and cheap, and as a mere recorder of connections can not be excelled. The device is so applied to an ordinary magneto call bell that it in no way interferes with the reception of, or response to, "in" calls, but can not be utilized for "out" calls until the required coin or token for which it has been adjusted is introduced through a suitable escutcheon. This done, however, central can be called as often as may be necessary to secure a response from the switchboard divinity. The removal of the telephone from the hook discharges the coin or token into the locked or sealed receptacle, and before another connection can be obtained another coin or token must be expended. Thus the number of legitimate coins or tokens found in the till when opened by the collector in the presence of the subscriber or his representative must tally exactly with the number of connections had through the telephone since the till was last emptied.

The accompanying illustrations will give the reader a good idea of the appearance of the toll box in question, and of the manner in which the toll-taking device is applied to the magneto call bell.

These connection registers can be utilized in several different ways—either as plain toll boxes operated by coins of a denomination for which they have been properly escutcheoned and adjusted; by specially designed tokens to be sold to all comers at rates scaled according to the number purchased at any one time; or by tokens furnished gratis to measured-service subscribers and designed to act simply as connection recorders.

Nicely designed tokens of aluminum or nickel, the exact diameter and thickness of five or ten-cent coins, suitably stamped, would doubtless be preferable to other sizes or styles, as either a token or a coin could be used to operate the device, their function being merely to bridge over or close a break in the generator circuit of the magneto.

Let the manager of any small or medium-size exchange where the rates have been reduced to a low figure by competition, have careful records kept of the daily local connections made on his telephone switchboard, and then figure out his annual income from his flat-rate subscribers and divide the amount by the total number of connections for the entire year, and he will find that he is receiving only a fraction of a cent per connection. In an exchange of over 1,200 stations, the daily income divided by the total daily connections showed an average of only one and two-tenth cents per connection. This is not a fairly adequate compensation for the important and valuable service rendered, when the saving of time and street car fares is taken into consideration. Were it practicable to eliminate the connections made for non-paying customers, and confine the service to those who pay for it, the number of connections would be reduced about one-half, and, the income remaining the same, the receipts per connection would be doubled, to say nothing of the decrease in the operating room expenses made possible by the reduced usage of the telephones.

It must be conceded that the introduction of a purely toll system in lieu of the universal fixed rental systems will largely reduce the number of connections, but I believe this reduction would be compensated for by the increased patronage of the general public induced by the universal sale of tokens and the general invitation to the entire community to avail themselves of the time and street-car saving advantages of the exchange system. While a large proportion of our citizens do not scruple to use the telephones of their neighbors without making any return for the privilege, there are a still larger number who rarely ever practice such imposition, but utilize the street cars and sacrifice time, rather than annoy a neighbor or impose upon the telephone company. This class would soon learn to utilize the toll system and their patronage would go far towards keeping up the maximum daily record of connections.

Granting, however, that there should be a falling off of, say, even 50 per cent of the daily connections, an average of two and a half cents per connection would more than compensate for the loss and at the same time materially lessen the cost of operation by enabling the exchange management to decrease the operating room force.

The special system of toll service most suitable for each exchange would have to be decided by each manager upon data furnished by the exchange itself under existing conditions, but one or the other of the following schemes would doubtless be found to apply satisfactorily in all cases:

1. The "measured-service" system at rates scaled according to the number of connections, furnished to as many patrons as prefer it, while the flat rental for unlimited service is continued for all others.

2. A fixed installation charge to cover the cost of the station outfit and wires, payable when the telephones are installed, with toll box tokens to be sold to all comers at rates scaled according to the purchases.

3. A reasonable flat rental charge to cover the "in" calls, and the measured-service or the scaled-rate system for the "out" calls, subscribers being allowed to dispose of their tokens to outsiders at the usual single-connection rate, thus recouping themselves to some extent on the cost of their service.

4. Furnish tokens gratis to regular patrons only and charge them rates scaled according to the actual number of connections had, tills to be opened and settlements made monthly or quarterly as may be deemed best.

The above are a few of the many ways in which the toll principle in connection with automatic recording devices may be applied in lieu of the inequitable fixed rental method of dispensing telephone

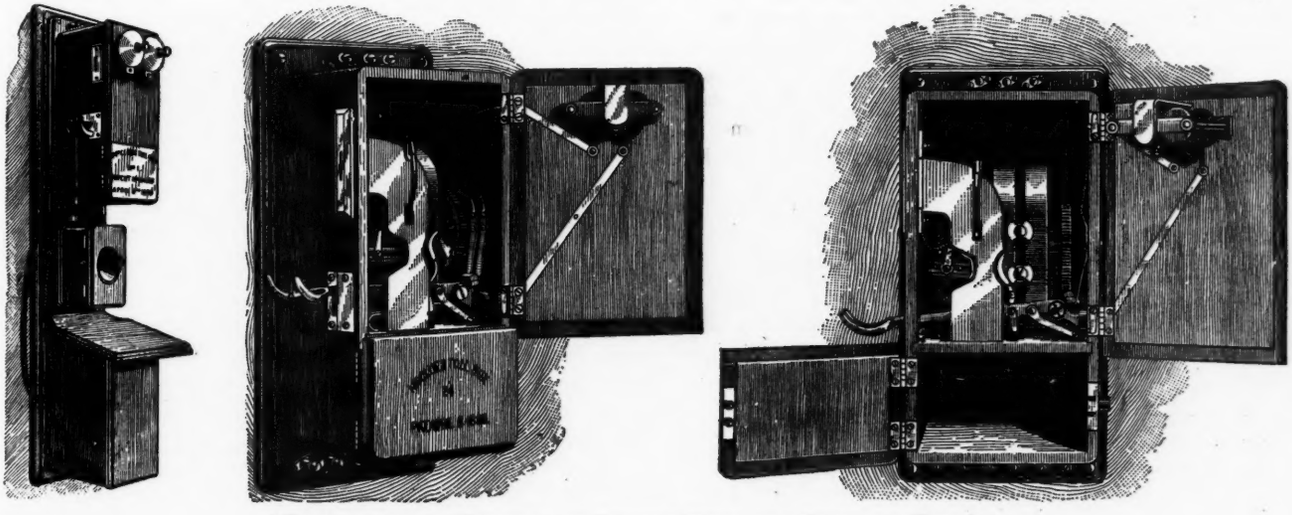
service. Variations therefrom, in order to meet peculiar conditions, can be devised as the judgment of the telephone manager may suggest. But under almost any conditions a carefully devised and judiciously applied toll system, whereby the exchange service is thrown open to the general public without onerous restrictions, will almost certainly result in lessened expense to the regular patron and a gratifying increase in revenue to the telephone company, accompanied by a material reduction in operating expenses as compared with the receipts.

It has been found by practical experience that even a comparatively small number of automatic toll-box stations, judiciously located, will add considerably to the exchange revenues, and relieve neighboring subscribers to a gratifying extent from the annoying intrusion of the non-subscribing fiend with the stereotyped "I want to use your 'phone a moment."

The measured service scheme is the half-way mile-post between the flat-rate and the purely toll systems, in that it combines the advantages to the telephone companies of securing, at least in part, payment for service "in advance," as is generally required from flat-rental patrons, and a revenue from every connection ordered, while the subscriber enjoys immunity from the annoyance of non-subscribers and pays only for what he receives.

The increasing cost of operation, maintenance and reconstruction of plants and switchboards, keeping pace with the rapid increase in patronage, and the necessarily increased investments in underground conduits and metallic-circuit cables and central energy switchboards and apparatus on the one hand, and the popular clamor on the other hand for reduced rates, places the telephone manager in a very unenviable position. He must meet the views of investors, and bolster up the price of his stock by declaring an occasional dividend, but he can not increase rates without raising a storm and driving his patrons to the other company. Hence, in order to keep the balance on the credit side of his balance sheet he is driven to the enforcement of petty economies in the operating and maintenance departments, to the detriment of the service and the injury of the plant.

The present tendency to introduce improved methods and apparatus requiring a more thoroughly competent class of employees, with the accompanying increase in the footings of the pay rolls, coupled with the increasing demand for lower rates, must have the effect of hastening the introduction and spread of the measured service or other toll, and "party-wire" schemes, designed to increase receipts and decrease expenses. The exchange service must be put on a basis that will entirely eliminate the "free list," and bring to the companies an adequate revenue for all service rendered. This done, the companies may hope to continue (or resume) payments of dividends, and at the same time satisfy the pressing demand for low rates.



FIGS. 1, 2 AND 3.—EXTERIOR AND INTERIOR VIEWS OF A TELEPHONE TOLL BOX.

Electric traction will shortly be inaugurated on the tow path of the Miami & Erie Canal by a Detroit promoter, who has secured permission to lay an electric railroad along the tow path. It is claimed that the system will not be an experiment, as it has been demonstrated by previous attempts that an electric motor can haul a load of 500 tons as easily as 50 or 60 tons may be drawn by mule power.

ELECTRICAL ENTERPRISE IN ARGENTINA.

BY ERNESTO DANVERS.

(Concluded from page 525.)

River Plate Electric Light and Traction Company—This company, which also owns the stations at Rosario, Tucuman and La Plata, employs the monocyclic system in Buenos Aires. The station was opened in 1898. The primary mains have a tension of 3,400 volts and the secondary distribution is on the three-wire system, with 440 volts between the outers. There is no teaser wire, and only very few motors of small power are supplied with current. The machinery consists of two horizontal compound McIntosh & Seymour engines of 700 horse-power each, direct-coupled to General Electric Company's monocyclic alternators of 500 kilowatts each, with a periodicity of 60 at full speed; *viz.*, 150 revolutions per minute. Three boilers of 300 horse-power each, Babcock & Wilcox, working at 145 pounds per square inch, having superheaters and Greens economizers. Exciters are rope-driven off crank shaft.

Cia. Alemana Transatlantica de Electricidad—Commenced business in Buenos Aires in 1898, employing the three-wire system with bare neutral. The use of this system gave rise to considerable discussion, as it was stated that the damage from electrolysis would be very great, but so far no damage has occurred to the gas and water pipes. The station comprises the following machinery: Eight Babcock & Wilcox boilers, each capable of developing 1,000 horse-power. Three engines of 1,000 horse-power each, horizontal, compound, direct-coupled to an Allgemeine Elek. Ges. direct-current dynamo. The engines are built by Tosi, of Lugano, Italy. Two engines of 2,000 horse-power each, triple-expansion. These are also direct-coupled to two dynamos each; the dynamos are of the three-wire system, with separate collector ring for the neut-

ral main. The pressure in the outers is 440 volts. Current is also supplied to the Buenos Aires Electric Tramways Company.

Municipal Station, Belgrano—The machinery comprises a 15 horse-power "Locomovil" engine, belt-coupled to a direct-current dynamo of 120 volts, 100 amperes, which supplies current to 22 arc lamps. The arc lamps in Flores and Belgrano are of eight amperes, and are run two in series. The plant at the new slaughter houses, in Liniers, which also belongs to the municipality, has the following machinery: Three multitubular boilers, with 55 square metres heating surface each. Two locomotive boilers with 40 square metres heating surface each. Two compound horizontal engines, 60 horse-power each at 175 revolutions. Two Weigher & Richemond engines of 35 horse-power each. The dynamos are as follows: Two Thury, of 225 amperes, 120 volts; one Allgemeine, of 150 amperes, 120 volts; one Allgemeine, 300 amperes, 120 volts; one Westinghouse, 200 amperes, 120 volts. All of these are belt coupled. They supply current to 100 enclosed arcs of 5 amperes, 120 volts; 20 arcs of 8 amperes, two in series, and 300 incandescent of 16 candle-power.

National Government Stations—Docks—This supplies current to 212 arc lamps of 400 watts, the average cost per month being $12.36 gold per lamp.

Riachuelo Station—Supplies current to 169 arc lamps of 350 watts; cost per month, $10.88 gold per lamp. The lamps supplied by these two stations are not included in the totals of the public lighting service.

The Buenos Aires municipality is at the present time calling for tenders for the lighting of the whole of the city by means of some 7,000 arc lamps, but it is doubtful if any new company will be formed to take up the concession, and it would be much more convenient for the municipality to arrange with the existing companies to do the work, and they could find sufficient capital if the taxes were less, say if the five per cent tax on the gross receipts was taken off and the companies allowed to earn a fair interest on their capital.

The maximum cost of private lighting is fixed by the municipality every month according to the gold premium, but the average is about 0.186 cents gold per kilowatt for light and 0.099 cents gold for power. The cost of the public lighting for 10 ampere arcs is about $35 paper per lamp per month, with gold at conversion price of 227, and rises according to the rise in gold and is $43 per lamp with gold at 400.

Electric motors are coming rapidly into favor in industrial risks and there are, at the present time, motors for all purposes, such as lifts, power purposes, etc., in workshops of an equivalent of 1,000 electric horse-power, and this number is increasing rapidly every day. The increase in electric lifts has been most marked of late, those principally in use being of the Otis and Sprague designs. The following figures showing the working of an Otis passenger lift working in this city is of interest, as it shows how cheap this system of elevators is. The lift is capable of carrying 1,600 pounds at a speed of 225 feet per minute, the total run of the lift is 70 feet. The cost of the current is eight cents gold per kilowatt.

1900.	No. of trips.	No. of passengers carried, excluding attendant.	Cost per mth. $ oro.	Cost per trip $ oro.
January....	3,727	4,305	10.13	0.00271
February..	3,181	3,816	11.28	0.00354
March.....	4,302	5,004	11.25	0.00261
April.....	4,007	4,856	12.00	0.00299

The average cost per trip is slightly over a quarter of a cent gold. The motors are about equally distributed between the continuous and alternating systems. One theatre is heated throughout by means of electricity.

Rosario—The station belongs to the River Plate Electric Light and Traction Company, Limited, and was erected in 1890. The output is 470 kilowatts. The system in use is Ferranti alternators driven direct by cotton ropes. The engines are Messrs. Hick & Hargreaves' compound, vertical Corliss type. The boilers are Babcock & Wilcox water-tube, generating steam at 200 pounds per square inch. The distribution of mains for arc and incandescent service are entirely overhead. The public lighting by means of an arc lamp service is carried on by Ferranti rectifiers at a pressure of 2,600 volts at the secondary terminals. The price charged per kilowatt to private consumers, less a scale of discounts, is 30 cents, gold, per kilowatt, that for public lighting by means of 6.7 A. arc lamps is $10 gold and $10 paper. The arc lamp service was originally started with Brush machines driven off a countershaft. This was found to be uneconomical as the actual efficiency was only 52 per cent and the Ferranti rectifiers were then installed, and these have given a 78 per cent efficiency, but due to the impedence caused by the self-induction on the overhead mains, this improvement was to some extent an illusion, as the full load of each rectifier could not be run. The station is five kilometres from the sub-station where the rectifiers are situated. This is, so far as I know the only station were rectifiers run under these conditions, namely, three miles from the generators. In my opinion, rectifiers are not suited to hot climates, or to the conditions under which these are working.

The municipality has lately granted permission to a German company to lay underground mains and establish a central station on the three-wire continuous-current system. This company will soon commence work, and has a capital of 3,000,000 marks. The working of this company will necessitate the laying of underground mains by the existing company, so as to be able to compete with a 24-hour service, the actual service only being 12 hours.

Mercedes—Province of Buenos Aires, established 1891. The system is alternating, with Ganz alternators, rope driven, the voltage being 2,400, the output is 480 electric horse-power. Current is supplied to 3,000 lamps. Public lighting is by means of incandescent and arc lamps, the prices being $1.70 gold, per lamp, per month, for the former, and $12.50 gold per lamp, per month, for the latter. The private service charge is 45 cents per kilowatt.

Pergamino—Province of Buenos Aires. This station was opened in February, 1899, the machinery consists of one compound horizontal engine, coupled to a 60-kilowatt, four-pole dynamo, for private lighting. One compound vertical engine direct-coupled to a 70-kilowatt, six-pole dynamo for public lighting, which consists of 45 arc lamps of 10 amperes each, and 400 incandescent of 20 candle-power. The dynamos are direct current of 250 volts, and built by the Baltische Elektricitäts Gesellschaft of Kiel. The price for public lighting is $35 for each arc and $3.50 for each incandescent per month.

San Fernando—Established in 1888, and is therefore one of the oldest in the country. This station is another instance of what can be done by perseverance. It was started by two young Argentinas, Mr. Rufino Varela and Mr. Cuneo, who really had no previous experience, and to-day stands as a monument of what pluck and hard work will effect. The first machinery comprised one dynamo of 25 amperes 110 volts direct current. To-day the station provides the public lighting of San Fernando, Tigre and San Isidro, the latter suburb being six kilometres distant from the generating station. There are three 50 horse-power compound engines and 200 horse-power, with boiler-power for 450 horse-power. The dynamos are alternating and continuous systems, the total capacity being 250 kilowatts. The price charged for public lighting is $4.50 per 16 candle-power lamp, per month, the service being from sunset to 2 A. M.

Paraná—This station is now being erected, and will consist of three 50 kilowatts direct current 440 volts dynamos direct coupled to Reavell high speed engines. The balancing set consists of two Crompton two-pole dynamos coupled together and mounted on a common bed plate, each machine having an output of about 25 amperes at 220-240 volts. The public lighting will be done by means of 150 eight-ampere lamps, run nine in series. The wiring will be on the three-wire system. The price per arc lamp eight-ampere is $24 per lamp per month. Half the lamps run until midnight only.

San Nicholas—First installed in 1887, on the multiple series system (incandescent) with Brush machines, but this did not prove a success and was supplanted by an alternating plant which likewise proved a failure. The original multiple series system was again arranged and has been in service ever since. It belongs to the municipality, and is the only one of this system in the country. In 1899, a 15 kilowatt plant, 125 volts, was established for private lighting purposes.

Adroguè—Established 1889. This station consists of alternating and direct systems, the alternating plant comprises two Elwell Parker alternators 2,200 volts 76 amperes belted to a Corliss horizontal engine of 350 horse-power. The continuous current consists of two Edison, 110 volts 84 amperes and two 110 volts 180 amperes. There are two Babcock & Wilcox boilers. The public service is carried out by means of two circuits with 53 arcs in each in series the last lamp being 17,800 metres from the station. The distribution for the private lighting is on the three-wire system, for the continuous current. The cost per lamp for private houses is about $3 per month.

Santa Fé—Erected 1890, and belongs to the Santa Fé municipality, for the public lighting and consisted of the following plant: four Babcock and Wilcox boilers; four compound Davy Paxman 50 horse-power engines; four Gramme dynamos, 150 amperes, 220 volts; four Gramme dynamos, 150 amperes, 110 volts. The public lighting consisted of 120 arc lamps, and 120 incandescent.

In 1895, the boilers blew up, wrecking the station. This has since being reconstructed, and the machinery to-day comprises the following: four Gramme dynamos, 380 amperes, 110 volts; eight Gramme dynamos, 150 amperes, 220 volts; and two Gramme dynamos, 150 amperes, 110 volts; and four 50 nominal horse-power Davy Paxman compound engines, one "semimovile" Robey compound engine, 20 nominal horse-power; two Durr boilers (each boiler has a heating surface of 271 square meters and gives 4,000 kilos of steam per hour, working at a pressure of 10 atmospheres). The total output of the station is about 460 kilowatts.

Water is supplied by means of Worthington pumps. The public lighting now consists of 85 arc lamps and 65 incandescent of 32 candle-power, 70 volts. The arc lights burn up to 11 or half-past, when they are replaced by the incandescent lamps, until daylight.

There is also a special public lighting service which, together with the regular requires 460 amperes and 225 volts. Private service commences at nine in the morning and continues until daylight. The distribution is on the three-wire system with overhead mains with 460 volts between the exteriors. The capital that has been employed is about $140,000 gold. The monthly working expenses of the station average about $4,850 paper.

Mar del Plata—Established 1898. Consisting of three dynamos, 440 volts (known as three-wire dynamos). Two of the dynamos are 25 kilowatt, and the third 34 kilowatt; one is direct-coupled and the other two are belt-driven. There is also a battery of accumulators with a capacity of 650 ampere-hours. The public lighting consists of 106 five ampere arc lamps, which are run four in series. The private lighting amounts to about 2,800 16 candle-power lamps.

Córdoba Light and Power Company—It is the only station in the country worked by water power, and was established in 1898. Situated 32½ kilometres from Córdoba, the generators are three-phase, 60-cycle machines, generating 700 volts which, by step-up transformers, is raised to 10,850 volts, and at the end of the line step-down transformers bring the pressure down to 2,100 volts, and the network transformers distribute at 115 volts. The present capacity of the hydraulic station is 1,080 kilowatts, and extension works are being carried out for another 1,100 kilowatt. The present maximum load is 700 kilowatts. The carbide of calcium works which are being erected will take, as soon as it can be provided, 750 kilowatts. In time, 3,000 horse-power will be delivered to the carbide works. The city lighting is carried out by means of 10-ampere, continuous-current lamps, the dynamos being driven by electric motors.

Salta—The public lighting was inaugurated in September, 1898. The system is three-wire, 440 volts, with 220-volt lamps. There are, at present, installed two direct-connected, 100-kilowatt generating sets and three water tube boilers. There is also a battery of 260 Tudor cells, L. B. 15 type. Public lighting is carried on till 4.00 A. M., private till midnight. There are at present installed 700 lights (private) and 470 public. The former number will be practically doubled shortly, as the second 100 kilowatt direct-connected set is now being laid down. Prices for public lighting are $6 per month for 16 candle-power lamps till 4.00 A. M. For private lights the price is based on a charge of $3 per 10 candle-power lamp per month.

Santiago del Estero—Light was inaugurated at Santiago del Estero in 1889. The total capacity of the plant is 140 kilowatts, and there are 1,050 private lights and 570 public do, of 16 candle-power or their equivalent. The system is alternating, at 2,000 volts, transforming to 100 volts. Prices paid are $5 for public lighting till midnight; for private lighting, by arrangement, with discount system. To the electric lighting works is attached a large plant for sawing and grinding quebracho wood, and also for cutting railway sleepers.

La Plata—This station was opened in 1886. The machinery comprises two Ferranti alternators similar to those in Rosario, having also the same class of engines and boilers. There are also 19 25-lamp Brush direct-current machines of 9.6 amperes, and one of 10 lamps, these are driven from counter shafting placed below the centre line of the dynamo room, which shafting is belt-driven by six Davey-Paxman horizontal engines of 120 horse-power each, steam being supplied at 120 pounds per square inch by six locomotive boilers. The arc service is by Thomson-Houston lamps of 9.6 amperes. The Ferranti alternators work at 2,400 volts. The secondary distribution is by means of overhead mains, supplying current at 100 volts on two-wire service. The length of the arc circuits is 82,000 metres, that of the primary mains 50,000 metres, and that of the secondary 70,000 metres. The total output of the station is 460 kilowatts.

Tucuman—This station was opened in 1889. The system is alternating current with Ferranti machines 100 cycles. The alternators are of 100 kilowatts each, there being two of this size and one of 75 kilowatts, each being coupled to the shaft of a vertical engine, steam being supplied by three Babcock & Wilcox boilers, and one reserve, working at a pressure of 140 pounds per square inch. The effective power of the station is 275 kilowatts. The public lighting is by means of arc lamps, the length of the circuits for these is 22,000 metres, the primary circuits are 125,000 metres and of the secondaries 10,000 metres.

Private Plants—Perhaps the oldest, and certainly the most successful, private plant in this country is that of the Central Argentina Railway Company at their Rosario station. The plant was erected in 1887, and consisted of two 12 horse-power nominal Marshall & Sons compound stationary engines and boilers, three Crompton dynamos, 30 amperes, 300 volts, direct current, for arc lighting and one Crompton dynamo, 60 amperes, 110 volts, for incandescent lighting. In 1890 two 30 horse-power Robey compound engines and boilers took the place of the other engines and the dynamos in use to-day are three arc dynamos, 45 amperes, 300 volts, and three incandescent, 109 amperes, 110 volts. There are now 25 arc lamps of 15 amperes and 500 incandescent of 16 candle-power. It is very creditable both to the makers of the machinery and those who work it, that during the 13 years that the electric light has been in use, there has not been one serious breakdown.

General—It is only fair to state to those who have borne the brunt of the battle in early electric light installations in this country that not only have they had to fight the difficulties arising from the ordinary working of a station, but many an instance can be recorded where the municipalities have failed to pay for the public lighting service, although they have carefully collected the lighting tax from the public. Financial difficulties have then beset the electrical enterprises. There would be several more stations to-day throughout the country, if it were not for the municipalities, who put every difficulty in the way of legitimate enterprise and give concessions to concession mongers who hawk them about the market at fabulous prices, and it is needless to say that same are never taken up, whilst it is exceedingly difficult to obtain concessions for legitimate enterprise.

ELECTRIC TRACTION.

The first experiments in connection with electrical traction were carried out at La Plata by Mr. Cassels in 1892, so as to revalidate the patents, and a car was kept running for several months. No one connected with the tramways in this country had then any confidence in electric traction, and it was not until 1897 that the first line was constructed in the city of Buenos Aires, and was in connection with the concession granted to Mr. Bright for a line from the city to Belgrano. Two concessions had, however, been granted

previous to this, one to Sr. Villar in November, 1895, and another to Sres. Quesada Hnos., to-day the "La Capital Company."

The total number of concessions granted by the municipality to date number about 25. Concessions have also been granted for underground electric railways. Of the concessions granted, only three are working, namely, La Capital, Buenos Aires and Belgrano, and Buenos Aires Electric, although work has just been commenced on the converting of the Anglo-Argentina Company. The number of concessions granted is nothing to the number of applications made, as the concession fever seized the public, and it was on this account that so much harm was done to legitimate enterprise. It appears that some would-be concessionaire offered as a bait to the municipality that he would give free lighting in all the streets through which his line ran, and the result was that this clause was tacked on to all future concessions and was also added to those that had already been taken up. As was only natural, those who meant business did their utmost to have this absurd clause removed, but the city council refused at first to listen to reason and it was only when it was definitely shown that the companies already running intended shutting down, that the councillors finally discovered that the clause was impracticable and it was removed. The damage, however, had been done, as events happened which upset the financial market in London just as money was required for several first class enterprises, all of which have had to delay their progress.

There is a very large field open in this country for electric traction, especially in the leading cities; in Buenos Aires itself, a city with over 800,000 inhabitants, and which is rapidly extending, electric traction has a large field, as rapid transit is what is needed to prevent the population, especially the poorer classes, from crowding into a very limited area as they do at the present time.

Buenos Aires has before now been called the City of Tramways. There are 10 horse and electric lines working to-day, which represent a capital of about seven million sterling. The kilometrage is: Horse, 358; electric, 89.

The passenger returns for the year ending March 31 last were: 111,820,364 horse, and 16,584,576 electric, making a grand total of 128,404,940 passengers. The returns for 1898 were 105,964,631, an increase of 21 per cent in about a year. These figures speak for themselves.

Turning next to the electric companies at work, I have been able to obtain the following data:

La Capital—Total length of line January, 1900, 26.82 miles, main line open. Car shed and supplementary tracks, 3.47 miles. Track rebuilt but not yet open, 1.687 miles, making a total of 32 miles. The first section was opened on December 5, 1897.

The system is the overhead trolley. The total capacity of the generating station is 900-kilowatt generators. One battery of accumulators, 1,000 kilowatt-hours and one battery of 450 kilowatt-hours. This company serves the new slaughter yards at Liniers, where it has an elaborate system of sidings and four electrical traveling cranes for lifting meat boxes. The system throughout is the overhead trolley. This is the only traction company which has its own power station, as the Belgrano is supplied by the Cia. General and the Buenos Aires Electric by the Cia. Alemana Trasalantica. The capital of La Capital is £590,000.

The Buenos Aires and Belgrano Electric Tramway has a total capital of £1,103,085, and a total length of line of 52.62 kilometres single track and including all sidings 54.615 kilometres. The system is the overhead trolley throughout.

The cars are all made in the United States. The motor rolling stock amounts to about 150 cars. The feeder cables are laid in Doulton earthenware conduits, are lead covered, and made by the British Insulated Cable Company. The following figures concerning mileage and passengers are of interest:

Year 1899, miles run, 2,591,686; passengers, 10,569,891; receipts, £115,924.

Year 1898, miles run, 1,357,915; passengers, 6,945,783; receipts, £66,598, which gives an increase for 1899 of 1,233,771 miles run, 3,624,108 passengers, and £49,326 receipts. In the directors' report for 1899 I find that the receipts per mile were nine and one-quarter pence. The average consumption of current per mile run for 1899 was 1.3 of an English Board of Trade unit (1,000 watt-hours); this figure has since been reduced to 1.2.

The Buenos Aires Electric Tramway was commenced in 1899 and about five miles of single track has been constructed. This line starts in Calle Cordoba, at Callao, and will finally go to Belgrano and Flores and will join up these two suburbs. The overhead trolley system is the one employed.

GENERAL.

Amongst the smaller electrical enterprises are the city messenger service, which dates back to 1888, and to-day has six offices, 49 circuits and 3,312 call boxes; in 1899 the calls numbered 262,000; the "ticker," which was inaugurated in 1899 is to be found in all the banks and large business houses.

During the past two years there has been considerable movement in the medical profession in connection with the application of electricity, and to-day there are several very well fitted up laboratories with all the latest inventions, to be found in the city. Electric railway signalling is also another enterprise of some importance, and every year is coming more into use on the railways. The sugar refinery in Rosario employs electricity for the refining of the sugar but the process is kept a profound secret. In Buenos Aires there are now to be found several large electroplating establishments. Before long it is probable that electric smelting works will be established up country; there are already two carbide of calcium factories in course of erection in Cordoba. In fact, the uses to which electricity is being put in this country are extending daily in the large field open for this development.

The following is a description of a small private power plant, the first of its kind in the country, that has lately been installed in a wool-washing establishment. The generating plant consists of two 200-horse-power compound steam engines, working at 250 revolutions per minute, made by the American Engine Company, of New York. These are direct-coupled to two 150-kilowatt dynamos, generating current at 220 volts; the dynamos are compound wound with eight poles. The motors are of different power according to the machine that they have to work; two are of 60 horse-power, with six poles, and 390 revolutions per minute; two of 40 horse-power, at 420 revolutions; two of 25 horse-power. Special circuit breakers are employed. Each motor is provided with a resistance. The motors and generators are of the C. & C. Electric Company, of New York.

Capital—I have endeavored to work out the total capital employed in electrical enterprises in this country at the present time, with the following result:

	Gold
Electric light, public companies	$9,000,000
Electric light, private installations	500,000
Train lighting	100,000
Telephones	5,300,000
Telegraphs (cab'es not included)	6,000,000
Tramways	15,000,000
Various companies	200,000
Impo'ters, contractors, etc., etc...	3,000,000
Total	$39,100,000

Or say, very nearly eight millions sterling.

Automatic Telephone "Centrals."

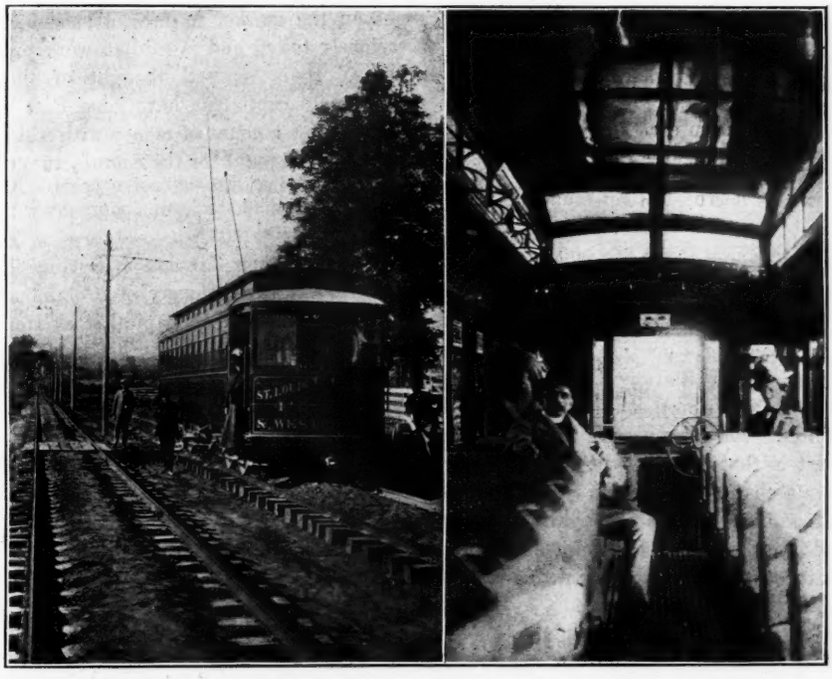
An English paper, in speaking of the discontinuance of the telephone "centrals" in Paris, says: One of the "own" correspondents of a morning paper, writing from Paris, says that "telephone girls" are being replaced by the invention of an auto-commutator, which permits the obtaining of any communication by the simple manipulation of a dial. The apparatus consists of a series of disks bearing numbers, which the subscribers first bring into the desired combination, and then ring. If the line is not clear, the fact is made evident automatically to the caller. "M. Millerand and M. Mougeot, the Under Secretary for the Postal Telegraphs, have installed the apparatus between their offices and 100 post offices. The machine has been working well for the past week, and a public trial will soon be made in a small town." Our readers may remember that an automatic arrangement was invented in America some years ago, but has, we believe, not proved altogether successful.

A Telephone Despatching System For a Suburban Trolley Road.

On the St. Louis, St. Charles & Western Railroad Company's suburban electric line, running from the city limits of St. Louis westward for some miles, an ingenious and satisfactory telephone system of communication between the general offices of the road and the cars is in use. The accompanying illustrations give some idea of the method employed, which is due to the ingenuity of Mr. J. D. Houseman, the secretary and general manager of the system.

As shown in Fig. 1, a telephone line runs along on the top of the poles from which the trolley wire is suspended, the line consisting of two wires forming a metallic circuit. On the car is carried a jointed fishing pole on the tip of which are mounted two hooks, one of them having a spiral spring adjustment so that the two may bear at all times upon both wires of the circuit. These wires are put up one over the other and naturally on account of the impossibility of making the tensions equal they are at varying distances from one another. Connecting the two hooks to the butt of the pole is a circuit of flexible wire, looped along the sections of the pole much as a fishing line would be. The end of the car is provided with a plug for attachment to a socket under the canopy of one of the car vestibules. It is said that without warning the crew the car can be stopped and connection established in one minute, sometimes less, without either the conductor or the motorman leaving the car.

Fig. 2 shows the interior of one of the cars with a telephone in use. The instrument is stationary in the position shown and is ready for use at any time. Contact is said to be excellent and the transmission of speech very plain and distinct.



FIGS. 1 AND 2.—A TELEPHONE DESPATCHING SYSTEM FOR A SUBURBAN TROLLEY ROAD.

Telephones at Steamship Piers.

If the telephone pay station which has been recently inaugurated on one of the steamers of a large transatlantic line is found to work satisfactorily, it seems likely that the plan will be generally adopted, as the matter is one of great convenience to passengers who, in the hurry of embarkation, neglect some important duty, or fail to give instructions until it is too late. The telephone is of the ordinary type, with a plug connection on deck, no further attention being required except at the switchboard of the central office, thus enabling merchants to carry on business up to the very moment of sailing. This will apply not only to men of affairs, but to the somewhat romantic young lady who, in the words of the exchange, "desires to say good-bye to the other fellow."

Disregard of the block signals in the recently inaugurated Metropolitan Underground Railroad, of Paris, France, caused a disastrous smash up near the Place de la Concorde, which destroyed one car, put out all the electric lights in the tunnel, and injured about 30 people, two of whom have since died.

Electric Railways

Elyria financiers have in contemplation the construction of an electric line from Norwalk, eastward, through Berlin and Florence, to connect with the Cleveland, Elyria & Western.

Manager Charles Smith, of the Findlay Street Railway, announces that his company will extend its line north from Mortimer, the present terminus, to North Baltimore, a distance of five miles.

The directors of the Mill Creek Valley Street Railway Company, Cincinnati, Ohio, have awarded the contract for the brick work on the company's new car barn and power house in Hartwell, to local parties at a cost of $25,000.

The Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company is now putting in service four new 50-horsepower motor cars. With these additions they expect to lessen their schedule time between principal points very materially.

Cars are now running on schedule time on the new electric line for a part of the distance between Shelby and Mansfield, Ohio. The work is being pushed vigorously and by the first of the year it is hoped to have the road in complete operation.

The president of the Toledo, Ohio, Fremont & Norwalk Electric Railway states that work on the Genoa-Marblehead electric line will be commenced as soon as the main line is completed to Norwalk. The extension to Tiffin will be commenced about the same time.

Work has been commenced on the power house for the Urbana branch of the Dayton, Springfield & Urbana Interurban line which will be located at Glen Echo, Ohio. The big stationary engines are now being put in place and it is expected that the line will be completed this week.

The Southern Ohio Traction Company, of Dayton, Ohio, has made application to the state board of public works for rights-of-way over a portion of the Miami & Erie Canal, but it is hardly possible that they will get it, as the board has declared against the granting of franchises to railroad companies.

The ordinance granting the Urbana, Ohio, Mechanicsburg & Columbus Electric Street Railway a franchise over the streets of Columbus has been recommended for passage by the board of public

works. The ordinance provides for a 25-year franchise and that the work must be completed by July 1, 1902.

The Toledo, Bowling Green & Fremont electric line has a branch to Trombley, Ohio, and as the distance from North Baltimore to Trombley is only five miles, it is thought the owners will extend the road, which will give the people of Findlay and vicinity a continuous trolley line into Toledo by way of North Baltimore.

The city council of Kent, Ohio, has granted a 25-year franchise to the Portage Lakes Traction Company. The new line extends from Cleveland to Ravenna, by way of Hudson, Twin, Pippin, Brady Lakes and Kent. Ex-Congressman Taylor, of Bradford, is at the head of the company, and work will begin within the next few weeks.

The Toledo, Bowling Green, Ohio, Road has been sued for $10,000 damages by Richard Skeldon, administrator of the estate of George W. Skeldon, who was killed by the company's cars last December. Frank S. Ewing has also brought suit against the Columbus Street Railway Company for $10,000 damages for injuries received last January.

The showing made by the first yearly report of the Jersey City, Hoboken & Paterson Street Railway Company is considered by the officials of the road to be more than satisfactory, showing as it does $100,000 clear profit for the first fiscal year. At a recent meeting of the company the president was reelected and several of the old directors were continued in office.

The Cincinnati, Ohio, Lawrenceburg & Aurora Electric Railway has inaugurated a new theatre car service on its line for the accommodation of its patrons. It will be run on Tuesday, Thursday and Saturday evenings. Cars will leave Anderson's Ferry, the eastern terminus of the main line, at 12 o'clock each night and will connect with the Harrison division cars at Cleves Junction.

A foreign contemporary states that the Astrakhan Electric Railway, of Russia, has been opened and cars are now running over its entire length, 12 miles. The fuel burned in the furnaces in the power house is naphtha, the reason being that Russia is singularly rich in oil fields, the production being unusually heavy, and the oil itself being much cheaper and more economical in many respects than coal.

It is stated that the promoters of the new Dayton & Troy Electric line are well pleased with the progress they are making on their line. The Tipp City Building Company has donated land for the power house, car sheds and repair shops. Bids for electrical machinery and steam engines have been advertised for; the bridges, which will be of steel, have been contracted for and work has begun on the stone abutments.

A report from Syracuse, N. Y., states that the first sale of a street railway franchise since the White charter has been in operation occurred recently, the franchise bringing $1. It was bought by the Syracuse & Oneida Lake Railroad Company, no other company bidding. The remarkable part of the whole affair is that the cost of advertising the sale amounted to $504.

Suit has been brought against the Tennis Construction Company for $62,000, by the Cincinnati, Lawrenceburg & Aurora Electric Railway. The latter claims the construction company took the contract for building the road and was paid the full amount of the contract price before the work was done. It then found itself unable to complete it, and the railway company advanced it the $62,000, which they claim has not been repaid.

Residents of Avondale, Cincinnati, Ohio, are circulating a petition asking the Cincinnati Street Railway Company to run every third car on that line an open car all Winter. The reason assigned for the request is that patrons who so desire may have a chance to ride in a car that is not so confined and tainted with bad air, and in order that men may have an opportunity to smoke. They claim this is done in many of the large cities.

At a meeting of the stockholders of the Western Ohio Electric Railway Company held in Cleveland last week, the following officers were elected: A. E. Elkins, Cleveland, president; J. R. Nutt, Akron, 1st vice-president; L. J. Wolfe, Cleveland, 2d vice-president; M. J. Mandelbaum, Cleveland, treasurer; Jacob Mayer, Cleveland, secretary. This company is building a 32-mile line on private rights of way from Lima to Wapakoneta.

A plan is on foot in Toledo, Ohio, to connect Bryan, Napoleon, Bowling Green and Fremont with electric roads, as well as other towns in that part of the state. The plan is to build from Woodville to Bryan and operate in connection with the Toledo, Fremont & Norwalk, also crossing the Bowling Green Road, and thus connecting with Toledo. Other towns that would be included in the circuit would be Defiance, Hicksville, Williams Center, Framer, Evansport, Stryker, Weston and Grand Rapids.

Chicago capital is heavily interested in the proposed railroad to be built between Belfast and Northport, Me., more than half of it having been subscribed already by a gentleman from Illinois. It is believed by the promoters of the road that they will not have any great difficulty in obtaining their franchises and that construction of the line will not be as expensive as it has been in other cases. They also state that when the road is finished and operations begun there will be little or no bonded indebtedness.

L. G. Wooley, of Kenton, Ohio, is the inventor of a new telegraphic fire-alarm machine which is said to be far superior to anything of the kind that has ever been put on the market so far. It has been variously tested and is said to work perfectly. It is so well thought of that Springfield capitalists have gone East to raise a large amount of money with which to establish a plant for the manufacture of the machine on an extensive scale. An effort will be made to form a company with a large capital stock.

The Columbus, London & Springfield Electric Railway Company, of Columbus, Ohio, has increased its capital stock from $1,000,000 to $1,500,000. J. S. Harshman is the president and the Hon. Emmet Tompkins is the secretary. A copy of the $1,500,000 mortgage given by them to the Continental Trust Company has also been filed with the city clerk. The company hopes to have the line in operation by the holidays in order to get its patrons into Columbus for their Christmas shopping.

A writer in the Chicago, Ill., *Record* states that one of the most effective means of creating heavy city travel is the consolidation of the great lines, and says: Experience shows that the aggregate travel on united lines exceeds by a large percentage the business formerly done by the separate properties. This may be partly explained by the fact that short distances are now ridden which were formerly walked because two fares were then necessary in order to ride, and this was considered too great an outlay for the accommodation afforded. It would appear, however, that the immediate benefit to those who ride upon the cars far exceeds the increased returns to the consolidated company. Where, before the union, two and even three fares in some instances had to be paid in order to carry the passenger to his destination, he may now take the same journey for a single fare by means of transfers and through cars which were previously impossible. Kansas City, Mo., is quoted as an example and the statement is made that about 60,000 passengers save five cents apiece every day in the year in the city alone.

Telephone and Telegraph

Capitalists of Chicago, Ill., have recently incorporated the Continental Telephone Company, with a capital stock of $2,500.

A new telephone line is being built in Goshen township, near Kenton, Ohio, for the convenience of the farmers of that section.

The Progress Telephone Company has made application for a franchise in Dayton, Ohio, but so far has not met with much encouragement.

A branch line from North Wales, Pa., on the Allentown road, to Shimmersville is being strung by the Interstate Telephone Company, of Philadelphia.

The Caldwell Independent Telephone Company, with a capital stock of $5,000, has been incorporated by W. H. Bowron and others, all of Caldwell, Ohio.

A 12-mile line in Clay County, Ind., will be built by a new company of business men and farmers which has been organized in the town of Brazil.

The independent telephone line between Marysville and Richwood, Ohio, is about completed. It was built by private subscription, but is well constructed.

The Elyria Telephone Company, of Elyria, Ohio, now has 724 telephones in use. A dividend of one and one-half per cent was declared on November 1.

The United States Telephone Company, of Cleveland, has increased its capital stock to $2,000,000. Henry A. Everett is president, and James B. Hoge is secretary.

The Conneaut Telephone Company, of Conneaut, Ohio, has increased its capital stock from $30,000 to $50,000. Ed. L. Barber is president, and J. G. Palmer is the secretary.

The Citizens' Telephone Company, of Shelbyville, Tenn., has secured a charter and is preparing to begin operations. The capital stock is $10,000, and is held by substantial citizens.

The city council of Mansfield, Ohio, has granted a franchise to the Star Telephone Company, after a vigorous fight against the proposition. The city now has three distinct systems.

A warm fight is on at Canton, Ohio, over the granting of a franchise to the Citizens' Telephone Company. The city council has had the matter in charge for some time and is still holding up the ordinance.

The Citizens' Telephone Company secured a 50-year franchise in Xenia, Ohio, Marcus Shoup, of that city, was the chief promoter. A number of important concessions were granted the city.

Mr. O. C. Obetz, manager of the local exchange at Urbana, Ohio, has been promoted to the management of the local exchange at San Antonio, Tex. Mr. Homer Robinson will succeed him at Urbana.

The Green & Western Telephone Company, of Mason City, Ia., has finished its long-distance lines to Dodge Centre, Minn. This company has now quite a far-reaching system, and plans for further extensions as fast as the weather permits.

The Marion, Ind., Telephone Company has been purchased by local capitalists, who will begin immediate extensions and improvements. Present estimates of the total cost of the proposed changes aggregate about $20,000.

The Norwalk & Huron County Telephone Company, of Norwalk, has been incorporated with a capital stock of $80,000. R. P. Hull, W. H. Harper, Jr., Jas. King Duffy, H. O. Bentley, and A. M. Beattie, are the incorporators.

A charter has been asked for by the South Carolina Telephone Company, of Columbia, S. C., which is capitalized at $500,000. The company will operate a telephone system between Columbia and Charlestown, extending it later on to other cities in the state.

The City & Suburban Telephone Association, of Cincinnati, has decided to increase its capital stock from $2,500,000 to $4,000,000. The chief reason assigned for the increase is the further improvement of the plant and the acquisition of additional property. .

The Warren & Niles, Ohio, Telephone Company is adding another section to the switchboard at the Warren exchange, affording a further capacity of 300 drops. Two new copper wire trunk lines are being strung between Warren and Niles, which will materially improve the service.

The United States Telephone Company has just completed a new exchange at Fostoria, Ohio, at an expense of $125,000. The American Telephone Company's apparatus is the one employed in the new exchange, the switchboard containing 600 drops with space for about 50 more. There are now over 400 in use.

A rehearing of the case of the city of Zanesville against the Zanesville Telephone and Telegraph Company by the Supreme Court of Ohio has been granted. The court recently held that the law which confers powers on the probate court to prescribe the terms upon which such companies may use the streets, when council fails to act, is unconstitutional. The decision was found to effect so many interests that the court was induced to rehear arguments.

The second annual meeting of the stockholders of the Millersburg, Wooster & Orville Telephone Company was held at Millersburg, Ohio, recently. There were present a number of the stockholders from Mt. Vernon, Wooster, Orville and Millersburg. The following officers were reelected: President, George Adams; vice-president, Frank L. Beam; treasurer, John E. Koch; secretary, B. C. Sill; general manager, M. M. Herron. A dinner was served at the close of the business session.

Judge Lamson, of the Court of Common Pleas at Cleveland, Ohio, has granted a perpetual injunction against the execution of the contract recently entered into by the city of Cleveland, for the construction of a new police signal system. It is claimed that the granting of the contract by the council had been influenced by corrupt methods, which alleged facts were adduced at a recent investigation into the city council's affairs. The petition for an injunction was filed by the City Director of Law.

The Merchants and Manufacturers' Association, of Toledo, Ohio, comprising over 100 of the leading manufacturers and jobbers of the city, have locked horns with the local Bell telephone people over the question of poor service. The association voted unanimously not to pay any bills until the exchange was put in perfect order. The contention was referred to the Chicago office, and it looked for a while as if the instruments would be removed, but they are still in service, though nothing is being paid for them.

An agreement has been entered into by a number of the independent telephone companies of Kentucky, looking to the ultimate establishment of a system of long-distance telephone service that will take in all of the larger cities and towns of the state. A meeting was held a short time ago at Lexington by representatives of the different companies, and the Kentucky Telephone Association was organized, which is to be the nucleus of the new state system. Twenty-three companies have signed an agreement not to sell out to any other concern and to be in readiness to enter the new combination.

Wall Street and the Electrical Stock Market.

Since the Presidential election the strength of the market has been increasing continually, reaching its climax on Saturday last. After the boom which followed the Republican victory there was the expected reaction, but this was a light and localized one. Most of last week's business was for investment purposes and though there were short profits realized by the speculative side, the prices remain rather unchanged. The confidence in the further development of the commerce and industry of this country for the next four years is so strong that the "bearish" sentiment could find no place in the market. Though railroad stocks held the lead in the number of transactions the industrials have been very active and showed great firmness in prices. There is no immediate reason for reduction in prices, so great is the feeling of security which spread all over the country after McKinley's election.

On the New York Stock Exchange, General Electric closed the week at 159½ bid and 160 asked, showing a gain of 11½ points for the week and a gain of 19 points for two weeks. The high point, reached to-day, was 165, a net gain of 5½ points for the day. The attention the stock has been receiving on the exchange is due, it is believed, to the excellent showing on its application for the listing of $4,415,000 of additional common stock. The report to the governors of the stock exchange covering a seven months' term is that the company has an earning capacity of something like thirty per cent per annum. The report is for the period subsequent to that covered by the last annual report, or from February 1 to August 31 of the current year. The October dividend of the company was at the rate of eight per cent and prior to that the dividend had been six per cent. It seems to appear that the present dividend could have been paid any time in the past five years, and the company is now earning about four times the present dividend rate. At the rate of sales for the seven months of this year the total sales for the year will be something like $25,323,000. Metropolitan Street Railway, of New York, closed at 170 bid and 170½ asked, indicating a gain of 2½ points. Brooklyn Rapid Transit closed at 70½ bid and 71 asked, showing a loss of 8⅛ points for the week. Third Avenue Railroad closed at 112 bid and 113 asked, indicating no change for the week. Manhattan Railway, of New York, closed at 111⅞ bid and 112 asked, showing a gain of 4⅞ points in one week, and a gain of 15⅝ points in the last two weeks. Consolidated Railway Electric Light and Equipment Company closed the week at 9½ bid and 9¾ asked. This stock is attracting considerable attention by reason of its activity and strength. The recent large demand for the stock seems to be due to reports which have come from Chicago in regard to the excellent service given by the company's lighting equipments recently installed on the cars of the Atchison system running from Chicago to the Pacific coast. About 50 cars equipped with the company's apparatus are now being run in this service, and 50 more will soon be added.

On the Boston exchange, American Telephone and Telegraph closed at 154 bid and 155½ asked, showing a gain of 1½ points for the week. Erie Telephone closed at 105 bid and 106 asked. New England Telephone was not quoted. The first annual report of the Massachusetts Electric Companies for the period ended September 30 was issued yesterday. This is the company that operates fourteen street railway and electric light companies. The annual report shows a balance equal to 2.6 per cent on the outstanding common stock.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Electric Company of America closed at 10¾ bid and 10⅞ asked, indicating a gain of only ½ point. Union Traction closed at 36⅛ bid and 36¼ asked, showing a gain of 1¾ points for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 20 bid and 22 asked, indicating a gain of 1 point for the week. Electric Boat closed at 17 bid and 20 asked, showing a loss of 3 points.

Wall street, November 17.

PERSONAL.

Mr. A. A. Thresher, president of the Thresher Electric Company, Dayton, Ohio, is visiting New York city on business.

Mr. T. J. McTighe, the well-known electrical engineer, has returned from a short business trip to London, where some important engineering and manufacturing propositions in which he is interested were closed.

Mr. H. R. Teepe has resigned his position as assistant to the general manager of the Electric Vehicle Company, of New York city. Mr. Teepe was previously associated for several years with Mr. John D. Crimmins as purchasing agent of the construction department of the Metropolitan Street Railway Company, of New York city.

Mr. Charles E. Dustin, president of Rossiter, MacGovern & Company, of New York, and Mr. R. C. Peabody and Mr. W. S. Barstow, of the Edison Electric Illuminating Company of Brooklyn, leave on Wednesday of this week for Cuba. They will be gone about a month, visiting the properties of the Standard Manganese Company, at El Cristo and Santiago, Cuba, of which company they are the president, treasurer, and secretary, respectively.

Mr. Augustus Manee, who has been for 26 years past in the police telegraph service of Brooklyn, N. Y., has been retired on half pay, at the age of 65 years. His friends in the department gave a dinner in his honor on Wednesday evening of last week. Mr. Frank C. Mason, superintendent of police telegraph, presided, and among others present were Police Inspector Brennan, Police Captain Dunn and Messrs. E. F. Peck, W. L. Candee, Frank Harrington, Clarence E. Stump and Judge William B. Green.

The executive committee of the American Telephone and Telegraph Company, composed of Mr. Alexander Cochrane, president *pro tem,* and Mr. Henry S. Howe and Mr. C. W. Amory, all of Boston, accompanied by Mr. J. P. Davis, of New York, returned on Saturday last from a visit of inspection to the large telephone companies of the middle states. The committee stopped in St. Louis, Chicago and other large cities and spent Friday and Saturday of last week in New York, returning to Boston Saturday evening.

Mr. Marston R. Cockey, of the John A. Roebling's Sons Company, New York, is the youngest living mason who has received the thirty-third degree. This was conferred upon him in Boston, in September last. Mr. Cockey is the Master of the Lodge of Perfection, of the city of New York, and was born on March 21, 1864, on the United States Reservation at Old Point Comfort. Mr. Cockey has a large acquaintance in electrical circles and is a son of Mr. Edward C. Cockey, the well-known official of the Western Union Telegraph Company.

Orders have been issued by the War Department relieving from duty Lieutenant-Colonel Russell B. Harrison, Inspector General, U. S. V., from the Department of Puerto Rico, and honorably discharging him from the service of the United States. Colonel Harrison's discharge is a result of the abolishment of the Department of Puerto Rico. He is a son of Ex-President Harrison, and made an excellent record in both Cuba and Puerto Rico during the recent campaign. He was formerly prominently identified with the street railway interests of Terre Haute, Ind.

The Automobile Show at the Grand Central Palace, New York City.

Following the recent exhibition of automobiles at Madison Square Garden, after an interval of only three days, came the Automobile Show at the Grand Central Palace, which was opened to the public on Wednesday night, November 14, and will run through this Horse Show week to November 24. The attendance at the Palace has been very satisfactory and manufacturers who were represented at the former show express themselves as being well satisfied and repaid for their exhibits at the Palace by the patronage bestowed upon them.

It would seem, judging from the sales that have been made and the general attitude of spectators and prospective purchasers, that most of the business done is transacted in the afternoon, the visitors at that time of day being wealthy people who have come not so much to look and to be amused as with a serious idea of purchasing. Conversations with several of the principal firms represented elicit the information that Manager Nathan has chosen an excellent time for his exhibition, as the affair at the Garden had drawn people from outside and given them a chance to see what the vehicles really looked like. Then when the Palace show opened they came there for the purpose of buying, the combined advertising having already done its work.

Notable among the exhibits in the Palace are those of the Electric Vehicle Company of New York, the American Electric Vehicle Company, Mobile Company of America, Locomobile Company, Woods Motor Vehicle Company, Strong & Rogers, De Dion-Bouton "Motorette" Company, Canda Manufacturing Company and others.

The track, in the centre of the auditorium, is the scene of hourly tests and exhibitions of the different vehicles and some exceptionally clever work has been done, many of the vehicles being sent around the course at unusual speeds. Some of them were very lightly loaded, in many instances having no one but the driver aboard. Several friendly brushes have taken place in the evenings when the track was less crowded between vehicles of different motive powers and, though no great speed was reached, they serve to liven the interest and keep everybody on the *qui vive* while they lasted. In the centre of the track an open space is left in which trick riding and fancy evolutions are hourly given by the demonstrators of the different machines, and some of them are very interesting. One machine in particular manœuvred in such a fashion as to draw the admiration of the crowd. Starting at the eastern entrance of the track, the machine was driven at a rapid speed across the open space until it seemed as if it must break down the rail at the other side of the track; suddenly the driver shut off the power, jammed his steering gear over and turned the machine easily and swiftly, sending it safely around in a circle just inside the track, smiling at the apparent consternation of those who, a moment before, had fairly jumped to get out of his way, though they stood on the outside of the track on the main floor. After spinning around inside the track for a few moments the operator tossed his steering handle over the dashboard, leaned back in his seat and allowed the machine to run by itself, finally reversing his power and sending it backwards in the same manner at as high a speed as the limits of the circle would permit.

Starting at the main entrance to the exhibition rooms and making a circuit of the exhibition the machines show up to particular advantage on account of the fact that they are scattered all around the floor of the building, leaving the track entirely open and giving spectators an unrestricted view of the automobiles, which, to the average sightseer or even purchaser, is the most interesting and practical part of the entire affair. To the right of the entrance and occupying a space possibly 150 feet long by 25 feet deep are the exhibits of two large electric automobile companies, the Electric Vehicle Company of New York and the American Electric Vehicle Company, the exhibits including about 50 different machines of all types from the small voiturette to heavy delivery vans, florists' wagons and large family conveyances. Further down to the west, on the same side of the building, is the exhibit of the De Dion-Bouton "Motorette" Company, which includes their fast road tricycle and touring machine.

Leaving the auditorium and entering the large exhibition room on the east side of the building the principal exhibits are found to be the Mobile and Locomobile companies, Strong & Rogers, of Cleveland, the various automobile papers and a tailor's exhibit of automobile clothing.

It is too early yet in the course of the show to predict the influence upon it by the visitors to the Horse Show, who will probably come in great crowds from their suburban residences and country houses as in former years, but it is confidently expected, both by the manufacturers represented and by the management of the show itself, that considerable business will be done with these people. A large electric vehicle company's representative said that it was his belief that in another season the yearly automobile exposition would be as much of a society event and of as much importance in the automobile world for both business and social reasons as the Horse Show is to the horse lovers at the present time.

The following is a list of the exhibitors at the show:

American Electric Vehicle Company, New York.

American Roller Bearing Company, Boston, Mass.

Automobile, The, New York.

American Automobile, The, New York.

Buffalo Electric Carriage Company, Buffalo, N. Y.

Baldwin Cycle Chain Company, Worcester, Mass.

Canda Manufacturing Company, New York.

Cooke Locomotive and Machine Company, Paterson, N. J.

Cohn, S. E., New York.

Chandler, John, New York.

DeDion-Bouton "Motorette" Company, Brooklyn, N. Y.

Dayton Electrical Manufacturing Company, Dayton, Ohio.

Denison Electric Engineering Company, New Haven, Ct.

Downing, C. J., New York.

Electric Vehicle Company, New York.

ELECTRICAL REVIEW, New York.

Gleason-Peters Air Pump Company, New York.

Gray & Davis, Amesbury, Mass.

Holyoke Automobile Company, Holyoke, Mass.

Hartford Rubber Works Company, Hartford, Ct.

Janney, Steinmetz & Company, Philadelphia, Pa.

Lehman Brothers (carriage heaters), New York.

League of American Wheelmen, New York.

Marlboro Automobile and Carriage Company, Marlboro, Mass.

Mobile Company of America, Tarrytown, N. Y.

New Haven Carriage Company, New Haven, Ct.

Overman Automobile Company, New York.

Oneida Automobile Company, Oneida N. Y.

Oakman Motor Vehicle Company, Greenfield, Mass.

Ryder & Mason, New York.

Rousseau, David, New York.

Standard Auto and Vehicle Company, Boston, Mass.

Strong & Rogers (electric vehicle), Cleveland, Ohio.

Thomas, E. R., Motor Company, Buffalo, N. Y.

Tripler Liquid Air Company, New York.

Woods Motor Vehicle Company, Chicago, Ill.

Electric Lighting

A vote will be taken in Tampa, Fla., on December 18, to decide upon the question of issuing $25,000 in bonds to provide for the purchase or construction of an electric light plant.

Bids will be received by the City Clerk of Big Rapids, Mich., until December 3, for the furnishing of 50 street lights. The conditions of the proposal specify 1,200 and 2,000 candle-power lamps.

The electric lighting plant at Kasson, Minn., was entirely destroyed by fire recently, and the village authorities have determined to rebuild it in a more modern manner, and on a somewhat larger scale than before.

A bond issue, amounting to $26,000, has been voted at Kingfisher, Okla., for the purpose of putting in an electric light plant for public illumination, and it is expected that active construction work will be begun within a very short time.

An electric light plant, which will cost about $3,000, is now being installed in the Department of Physics of the Virginia Military Institute at Lexington, Va. This plant is of the latest design and construction, and will be used for practical demonstration purposes.

As a result of the recent election two residences on West Fifty-sixth street, in New York, were elaborately decorated and illuminated with red, white and blue incandescent lamps, stretching across the front of each building, along the roofs, and from cornice to curb. The entire block was also illuminated in the same manner.

Permission has been granted to the Hartford, Ct., Electric Light Company to erect poles and string wires for the lighting of the city. The company has also been authorized to establish correct boundaries for the streets of the city, complaints having been frequently made that property owners have encroached upon the limits of the highways.

E. D. Smith, president of the Blanchester, Ohio, bank, has been made president of the Dayton & Maysville Electric Railway Company, which has just been reincorporated and its charter made to include a branch line from South Lebanon to Cincinnati. The main line is projected from Dayton, through Lebanon, and intervening towns to Maysville, Ky.

A report from Michigan states that the citizens of Port Austin have voted a bond issue of $15,000 to construct and operate a complete electric lighting plant and waterworks. Before the contracts are awarded or bids advertised a committee, appointed by the Common Council, will visit various cities and villages in the state investigating their systems and reporting accurately, so that Port Austin may have the advantage of the latest and best equipment that can be obtained for the money spent.

The citizens of Baltimore, Md., have authorized their superintendent of lamps, Mr. McCuen, to advertise for bids for lighting that part of Baltimore now controlled by the Consolidated Gas Company. Two plans are under consideration, and an inspection is to be made of the Utica and Ithaca, N. Y., lighting systems; one plan being to use incandescent lamps, and the other to allow the Welsbach Company of America to take the contract, under which it would furnish the entire city with gas lights, paying the salaries of all lamp lighters, and the bills for gas and lamp maintenance.

Construction work on the line of the Tonawanda Power Company, Tonawanda, N. Y., which is a branch of the Niagara Falls Power Company, has been begun, and the lines are in process of construction at the present time. The object of the company is to furnish Kenmore and Delaware avenues, in Tonawanda, with electric lights and power before the opening of the Pan-American Exposition, in Buffalo. It is expected that about 50 arc lamps will be required, and, as the capacity of the company has been recently increased, it is supposed that the light can be secured under a long-term contract at reasonable figures.

The Citizens' Light Plant, of Houston, Tex., is about to make improvements to its station which will cost in the neighborhood of $60,000, and, though the plant is pronounced to be one of the most modern and complete in the country, it has reached its capacity for incandescent lighting and residence fans. The demands upon it for arc and commercial lighting and motor service are so great, and the extension of the limits of residence lighting so enlarged, that nearly double its present capacity is required. The company is at present in the hands of a receiver, and, at a recent hearing, when the matter was brought up, it was recommended that the receiver be authorized to let the contract.

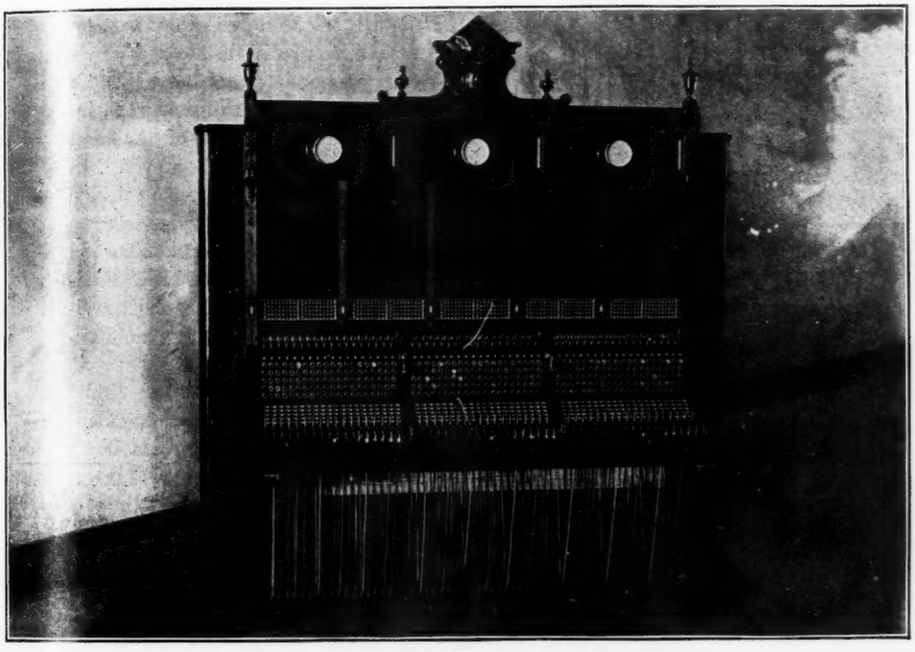
A report from San Francisco, Cal., states that within a few days the board of public works has decided to find out whether the lights charged for by the San Francisco Gas and Electric Company had really been in service each night, and instructed its police department that each officer must keep an accurate record of every unlighted lamp on his post. The first report in this matter was that in one night 17 electric lights were turned off before the proper time, and that nine of the gas lamps had been out all night. It is stated that this is a fair specimen of the looseness with which the matter is now managed, and the inspector who has charge of the lighting of the city says that the city can save about a $1,000 a month if an accurate record is kept.

A verdict of $3,256 has been given in the United States Circuit Court at Philadelphia, Pa., against Robert J. Peoples, for his failure to deliver the Yardley electric plant and franchises after entering into an agreement to deliver them to William F. Sadler, who had deposited $500 with him to secure the option. The verdict was in favor of Mr. Sadler and included the $500 which he deposited with Mr. Peoples as security when the deal was being negotiated. Mr. Peoples accepted the money, but when it came to delivering the franchise and equipment it was impossible to do so, and as he refused to return the deposit suit was instituted and the verdict obtained. Mr. Peoples alleges that his inability to deliver the franchises was that they were held by Councilman W. E. Maloney, of Yardley, who refused to part with them, but it is not known why Mr. Peoples refused to return the deposit.

There is considerable talk in Chicago, Ill., of relighting the whole city, many parts of which are now in total darkness. Having one of the largest electric light plants in the world it is remarkable that the city should be so badly illuminated, many spots being as light as day and many more being in Stygian darkness. The well lighted spots are practically a golden circle within the loop formed by the elevated railroads, while further out large districts are still dimly lighted by gas, gasoline or plain oil. The city electrician urges strongly that the water available in the Chicago Canal be drawn upon to furnish power for generating enough current to light the entire city in an even and thoroughly modern manner. At the present moment the only objection to this scheme is that the cost of such an undertaking would be about $2,500,000, and no one knows exactly how that money could be obtained, as taxation to cover the amount is believed to be impracticable.

A Swedish Multiple Telephone Switchboard.

The accompanying illustration shows one section of a switchboard recently imported from Sweden for a western customer of the Ericsson Telephone Company, New York city. The board is of 300 instruments capacity with positions for three operators, and is so arranged that other sections of the same size may be added to it, increasing the capacity thus by steps of 300 each up to 3,000 telephones. The board is of the full multiple variety and is claimed to be very simple, positive in operation, as well as easily accessible for connections, changes or repairs.



A Swedish Multiple Telephone Switchboard.

For convenience the board is divided into five panels with the plugs placed on two different planes; it is provided with series jacks and the subscribers' drops are restored by the operator. Each operator has 18 pairs of cords and plugs, the clearing-out drops automatically restoring themselves. Lines come in from the cross-connecting board, pass through jacks in the first multiple, and then continue on to the next corresponding multiple. From the multiple jacks wires connect to solder-tags on the intermediate field on the back of the board. This makes it possible to distribute the labor between operators, which is done by removing busy subscribers from one operator and placing them with another who has more time. From these tags the wires are connected with the home jacks which are placed on a sloping plane which is above the table leaf and from there they go to the subscribers' drops.

When the subscriber calls the exchange the drop falls and the operator places the answering plug, which is placed on the table leaf, in the home jack and at the same time pulls the lever of the table key toward the edge of the table to the speaking position. After ascertaining the desired number the operator takes the ringing plug, which is on the sloping plane between the subscribers' jacks and the clearing-out drops, and touches the jack in the multiple which corresponds with the desired line. If it is busy, there is a click heard in the operator's telephone, but if it is disengaged there is no sound and in that case the plug is placed in the jack and the second subscriber is called by pushing the lever of the table key toward the board to the ringing position. The table key returns automatically to its ordinary position and the two subscribers are connected with each other.

When the conversation is finished, the ring-off signal is given, the clearing-out drop falls and the plugs are removed by the operator. Each operator has a counter which automatically counts the calls issuing from the exchange.

Six keys marked in pairs are fitted in front of each section. They are used for speaking and ringing to each of the two connected subscribers, separately. If the operator desires to listen in or to speak to both the subscribers, the table key is pushed into its speaking position; but if connection with only one of them is desired, the keys are used. The call is generally given by the table key, but it can also be given by means of the other keys. Both the subscribers' and the clearing-out drops are provided with night contact, so that the night bell is rung when they are dropped.

ITEMS OF INTEREST.

Orders placed with a New York export house, which amount possibly to $60,000, are for an electric plant which is to go up in Kow Loon, China.

The Columbiana County Telephone Company, of Alliance, Ohio, is now complete and in successful operation. It has connections with Cleveland, East Liverpool, Youngstown, Lisbon and Salem.

Parties are now going over the route between Columbus and Chillicothe, Ohio, securing the right of way for the Columbus & Southern Electric Railway Company, which is being promoted by Chicago parties.

A wreck occurred on the line of the Cincinnati, Lawrenceburg & Aurora electric line early this week, as the result of a head-on collision resulting from disobedience to orders. A number of passengers were seriously injured.

The citizens of Marathon, N. Y., are agitating the question of municipal lighting of that town and expect that the municipal plant, which will have assured service, will save the town money and be of decided advantage to its citizens.

It is stated that the Hoboken, N. J., police have provided themselves with rubber gloves in order to avoid the danger involved in using the police department signal boxes, as an officer was severely shocked recently when telephoning to his station-house.

A mortgage of $650,000, given by the Cincinnati & Miami Valley Electric Railway to a Philadelphia concern, was canceled at Dayton, Ohio, recently. It was given to secure the bonds of the company and was made in 1896. This company has since been absorbed by the Southern Ohio Traction Company.

An electric railway 125 miles long will be built in Oklahoma and Indian territories by the Oklahoma Telephone and Railway Company, which has been incorporated at Guthrie, Okla. Ter., for $1,000,000. The line will run from Tecumseh, Okla., to Coalgate, I. T. It is estimated by the promoters that the road will cost $500,000. In addition to the railway system the company intends to operate lighting and telephone services.

Some Advantages of the Auxiliary Rail Joint.

For some time past there has been considerable discussion in railway circles concerning the all important question of rail joints. Too little attention is frequently given this important subject and it is not always realized that upon the rail joint depends not only the length of life of the rail but also, in large measure, the depreciation of rolling stock caused by bumping over bad joints of one sort or another. In an elaborate series of articles by Mr. F. C. Schmitz, published in a railroad contemporary, he summarizes the conditions under which all rail joints must operate in the following nine paragraphs:

"1. The joint must be efficient without stressing bolts beyond what is required to hold the joints firmly to the rail when unloaded, thus insuring proper expansion and contraction.

2. The joint should have proper bearing area to prevent cutting of rail head into splice.

3. The joint must take up the irregularities in rail sections.

4. The joint must hold the rail ends in such a manner that they act as the body of the rail in resisting bending upward as well as downward.

5. The joint should in no wise alter the running width of rail head.

6. The joint should be simple, easy of application and renewal and should not depend on the adjustment of one part against another.

7. The joint should require no special arrangement of track materials.

8. The joint should not require a special form of rail end.

9. The joint must have sufficient vertical rigidity to insure, for a given load, a deflection equal to but no greater than is obtained in the body of the rail."

Among the various types of rail joints, are included splices without bearings under the base of the rail, trusses or clamps around the base of the rail with no support under the rail head, two-piece splices carried around the rail base, plain splices bolted or clamped to the rail, bridge or auxiliary rails carrying the wheels over the joint, castings around the rail and splices supplemented by a base supporting device. It is claimed by the makers of the auxiliary type of joint that this possesses conspicuous advantages.

Referring to the illustrations, which show respectively a cross section and a perspective view of the Barschall rail joint, which has been installed on the lines of the Pennsylvania Railroad in this country and which has been in use for many years in Austria and elsewhere on the continent of Europe, the construction of an auxiliary rail joint may easily be understood. The joint, as is well seen, consists of three pieces and the necessary bolts. Counting from the left in Fig. 1, the first section shown is that of the auxiliary rail which is separated from the running rail by a filler of peculiar hour-glass section, this

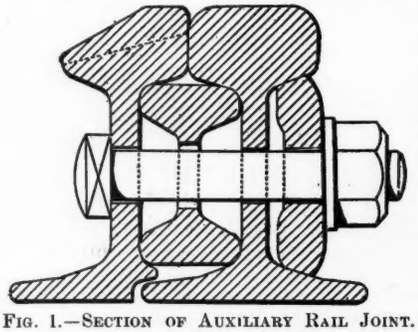


FIG. 1.—SECTION OF AUXILIARY RAIL JOINT.

being clamped against the rail by means of the bolt and plate shown on the extreme right. The whole structure is set down upon a base plate resting on the ties and its function is to permit the tread of the wheels running over it to run on the auxiliary rail as they pass the joint, thus making a noiseless and shockless

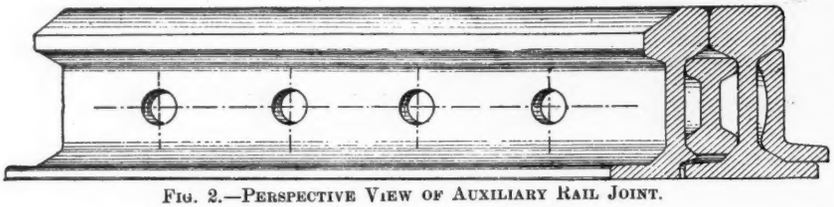


FIG. 2.—PERSPECTIVE VIEW OF AUXILIARY RAIL JOINT.

transfer of the wheels from one rail to the next.

It is claimed by Mr. Max Barschall, who is exploiting this joint in the United States, that it fulfils all of the nine conditions set down above except condition No. 5 which, he believes, is no longer sustained by actual experience. In addition the joint possesses some peculiar merits of elasticity. Owing to the curved surface of contact between the filler and the main rail and auxiliary rail a certain amount of flexibility is secured, either rail being able within narrow limits to play a little or roll upon the rounded contacts mentioned above, so the joint, while always accomplishing the transfer of the wheel neatly, still has flexibility. In this way even if a wheel is worn so as to have a "false flange" there will be no shock in the transfer of this to the auxiliary rail which will give a little. It is claimed that, even were a shock produced, the number of wheels on a train having such false flanges is a very small percentage of the whole, whereas with the ordinary rail joints every wheel encounters a shock in passing every joint.

The adaptation of this type of joint to street railway girder rails is easy and it is believed that much economy may be attained by its use. It has been found possible to re-lay tracks in which the ends of the rails are worn with this variety of splice and make virtually a new track.

Death of Fred W. Royce.

Mr. Frederick W. Royce, widely known as an electrician and veteran telegraph operator, dropped dead from apoplexy, in Washington, on Friday, November 16. He was 61 years old and a native of Delaware. Mr. Royce, who was for many years a partner in the house of Royce & Marean, was among the first to send a message on the old printing telegraph instruments, and became one of the most expert telegraphers in the country. In sending press telegrams he often attained a speed of 60 words a minute. He leaves a wife, who is seriously ill, and two sons and a married daughter, one son being Frederick Royce, Jr., the New England traveling agent of the Baltimore & Ohio Railroad.

Mr. Royce was one of the most kindly and genial of men, was a regular attendant at electrical conventions, and his death will cause very wide regret. The funeral occurred on November 19, and was largely attended by members of the telegraphic fraternity and others. A number of New York friends of the deceased sent an elaborate floral testimonial, which was delivered through the courtesy of Mr. M. Marean, the former partner of Mr. Royce. The ELECTRICAL REVIEW desires to express the sympathy of its entire staff to the sorrowing family.

A contemporary says that the latest exploit of Mr. William K. Vanderbilt, Jr., is racing with a train on the Long Island Railroad, to the discomfiture of the engineer. The race, which was entirely accidental, occurred between Garden City and Jamaica, where the roadway is parallel with the steam tracks. The train was moving leisurely along, after the manner of Long Island railroad trains, when Mr. Vanderbilt passed with his big French racing car at about double the speed of the train, and as he passed waved his hand in good bye to the engine driver, who, not to be outdone by an automobile, straightway pulled open the throttle and started in pursuit at his best speed, but when Jamaica was reached Mr. Vanderbilt had vanished in the dim distance, winning the race by about three minutes.

A Mechanical Substitute for the Horse.

A few months ago the ELECTRICAL REVIEW suggested that designs for new types of automobiles were needed, because the average automobile appeared to be a horse carriage minus the horse. The illustrations below represent a highly-ingenious attempt to produce an entirely novel type of self-propelling vehicle, which is adapted to be used in the place of the horse and attached as a tractor in front of any existing type of vehicle now drawn by horses. The machine is called by its owner, Mr. Lowell M. Maxham, an "automore."

Fig. 1 shows the machine in position in front of a light runabout buggy, while Fig. 2 is a plan view showing the construction and method of regulating and handling the apparatus. The machine consists of a pair of driving wheels and a motor casing suspended between them, together with a pair of short shafts or thills adapted for coupling it to any form of carriage and a pair of reins for its guidance and control. By removing the thills or carriage pole of the ordinary vehicle this machine can instantly be coupled to it without adding any new feature to the vehicle or in any way marring the carriage. The owner of several vehicles of different styles can hitch his automobile horse to any one that he desires, or change it from one to the other at a few moments' notice; any person accustomed to driving a horse can drive this machine, seeing that it is controlled in the same way by reins. As will be seen from the illustrations, there are two sets of reins, one of which is used only when it is desired to stop the machine entirely for a considerable length of time or to back it. A pull on the right-hand rein makes the apparatus turn to the right; the other rein turns it to the left, while a strong pull on both together turns off the power and applies the brakes. Relaxing the reins releases the brakes and turns on the power, while the machine may be permanently stopped with a second set of reins. While the design as shown contemplates the use of an electric motor, the apparatus is equally adapted for other motive powers. By an arrangement, which is claimed to be effective, the machine is securely prevented from turning to either side except when it is desired to turn it by pulling the reins, and it is claimed, therefore, that there is no danger of the vehicle taking an unexpected dart to one side of the road; in other words, it will not "shy." It is claimed that the reins can be dropped without the machine being ditched, even should one of its wheels strike an obstruction.

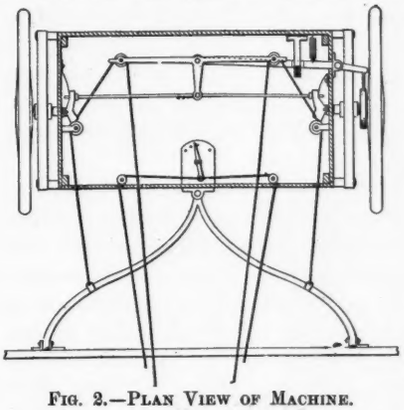


FIG. 2.—PLAN VIEW OF MACHINE.

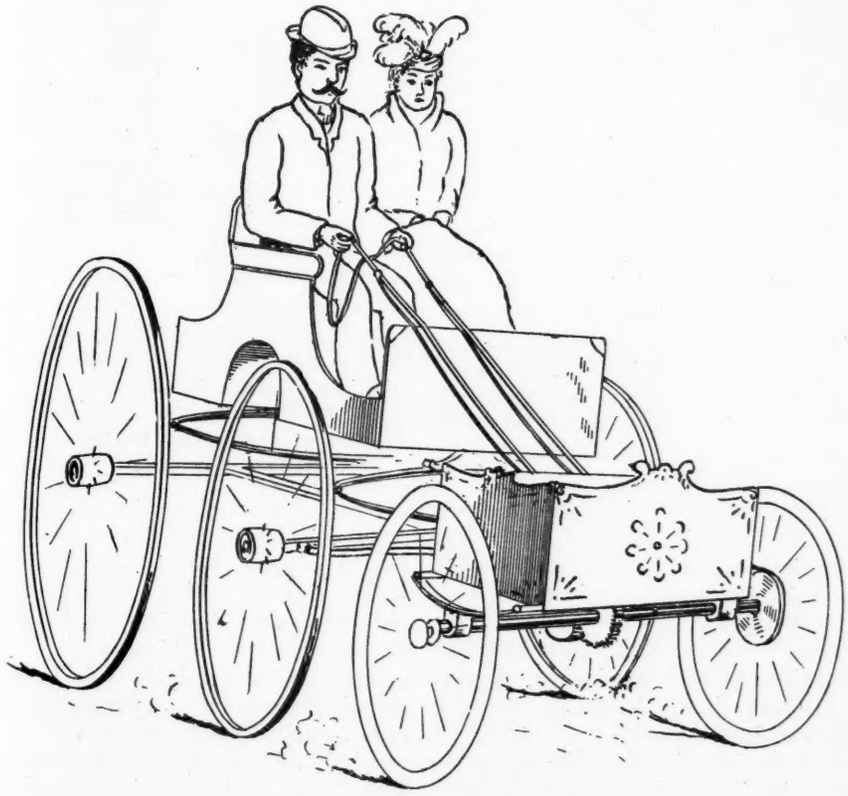


FIG. 1.—A MECHANICAL SUBSTITUTE FOR THE HORSE.

Among the numerous advantages which the inventor claims for this extraordinary vehicle is the saving in dead weight and expense, a saving in running expenses, an increased safety over the ordinary type of automobile and the suppression of the disagreeable jarring, leading to the complaint known as "automobile arm," which comes from handling the steering lever of the average automobile rigidly connected with its wheels.

An Automatic Automobile Charging Device.

At the recent Automobile Show held at Madison Square Garden, New York, the General Electric Company had on exhibition an automobile charging set called "the electrant." The electrant is a device for charging the batteries of electric automobiles. It is intended to be connected to the mains of an Edison system, and when so connected is suitable for charging automobiles having battery potential of 80 volts. In it is included a Thomson recording wattmeter of the railway type, provided with contacts on the dial, so that when the prepaid amount of energy has been delivered, a circuit will be made and the main switch opened.

Across the centre of the electrant, on the outside, are four plug receptacles, numbered 1, 2, 3 and 4, from the left. The resistance in series with these receptacles are so proportioned that 20, 30, 40 or 50 amperes will flow when charging an 80-volt battery from 110-volt circuit. When an automobile requires a charge, the plug carried by the automobile is inserted in any one of the receptacles. Upon turning the handle of the door, just above the receptacle, a contact is closed and current flows from the battery of the carriage through an electromagnet, in the electrant, and this magnet attracting its armature, releases the catch on the door and allows it to be opened. A coin may now be deposited in the slot in the apartment made accessible by opening the door, the switch handle turned down, and this motion is transmitted through the coin to an interior switch-blade, closing the main circuit. The handle must now be returned to its initial position before the door can be closed.

The closing of the door operates an auxiliary switch and current is fed into the battery. As long as the door remains open no current passes. When the prepaid amount of current has been withdrawn, a contact on the meter dial is closed and the main switch is thrown open, returning everything to its initial position as before the carriage arrived. The switch will also be thrown over provided the plug is withdrawn before the charge is completed, and any unconsumed portion of the prepaid energy reverts to the supply company. This may be avoided in order to change receptacles by pressing the contact button on the left, which prevents the closing of the contact through the release magnet.

ELECTION RETURNS BY TELEPHONE IN THE WEST.

BULLETINS POSTED SIMULTANEOUSLY IN THE DAKOTAS AND MICHIGAN.

The Michigan Telephone Company, Wisconsin Telephone Company, Northwestern Telephone Exchange Company, Southwestern Telegraph and Telephone Company and Cleveland Telephone Company, comprising the Erie system, made a special effort, on November 6, to beat all previous records in the distribution of election returns. The returns from the various eastern and western states were, as already mentioned in the ELECTRICAL REVIEW, handled in a very gratifying manner by the American Telephone and Telegraph Company. These returns, with local returns, were handled by the companies referred to above on a more extensive scale than ever attempted before. In Michigan alone, over 300 cities and villages received full returns, while the remaining 300 stations received sufficient returns to keep in touch with the general results. At Detroit, Grand Rapids, Saginaw, Sault Ste. Marie, Marquette, Ishpeming, Houghton and Calumet by far the largest crowds on the streets were in front of the stereopticon displays of the Michigan Telephone Company. The various stations in the upper peninsula of Michigan had never received the returns by telephone, the Michigan Telephone Company's long-distance lines having been extended north within a year. The speed, accuracy and completeness of the returns consequently caused considerable surprise. The receipt by telephone of returns in a national campaign was also a new feature in Minnesota, the Dakotas, Texas and Arkansas, while in Wisconsin the number of stations receiving the returns was more than doubled over 1896. It is estimated that, in the states covered by the Erie system, at least half a million people received election news by telephones—at clubs, halls, private residences, by stereopticon displays—a striking illustration of the development of the telephone. By the arrangements made the small stations throughout the states received the returns simultaneously with the posting of bulletins in the large cities.

The possibilities of the telephone in the collection of election returns are well illustrated by the following item from the Detroit *Evening News:*

"The Michigan Telephone Company was an important factor in getting an early tabulation of the vote in Michigan. The Michigan vote has usually been very late, but the telephone returns, as early as nine o'clock, indicated a Republican plurality of 65,000 or over. A rapid system of comparison with the vote of 1896 had been arranged by the telephone company, so that it was possible to take the vote of 50, 60 or 100 districts, scattered all over the state and give a comparison with the vote of the same districts four years ago.

"The Michigan service by telephone included long-distance bulletins furnished by the American Telephone and Telegraph Company throughout the country, and particularly fast and accurate returns were received. The various state committee chairmen were all in touch with the long-distance telephone, and many of the important bulletins were secured in this manner. The long-distance bulletins were furnished to the newspapers and clubs."

Andrew Carnegie Endows Another Polytechnic School.

A report from Pittsburgh, Pa., states that Mr. Andrew Carnegie has decided to establish a polytechnic school in that city, which he will endow with three million dollars, for the mechanical and technical education of the young men of Pittsburgh and neigboring cities. The school will be known as the Carnegie Institute. The Carnegie library in Pittsburgh has, for some time past, been collecting a large number of rare works upon technical subjects and it is believed that this collection will probably form an important adjunct of the proposed school, plans for which have been informally discussed by Mr. Carnegie and a number of his friends at the office of Mr. W. N. Frew, president of the board of trustees of the Carnegie library.

Mr. Carnegie's predilection for schools of this nature is illustrated by the fact that he has donated $250,000 to the polytechnic school at Birmingham, England, and $50,000 to one at Dunfermline, Scotland. Those who are intimate with him have hinted that his benefactions to the city of Pittsburgh will be on an unusually large scale when carried out, and show no hesitation in saying that they believe his intention is to make the Carnegie Institute the greatest educational organization of its kind in the world. So far all his plans have not been disclosed, but sufficient is known to warrant the statement that his present plans exceed in great measure anything of the sort that he has before planned.

An Automobile Funeral.

The statement of the old English lady who remarked once, "Funerals hain't what they use to be," was vividly illustrated at a recent funeral in St. Francis' Church, New Brunswick, N. J., when undertaker William J. McDede introduced into the proceedings an automobile bier. Everything went smoothly until the church was reached, Mr. McDede's assistant having attended to all the preliminaries and placed the automobile at the foot of the narrow aisle in the centre of the church. The pall bearers deposited the coffin upon the bier and the undertaker fell in behind the coffin in the narrow aisle with the pall bearers back of him and pressed the button of a concealed motor, whereupon the bier with its burden began to move toward the altar in slow and stately fashion. When the pall bearers realized what was going on they were said to be somewhat terror stricken and the congregation itself was thrown into consternation. One of the mourners started for the door; that started the crowd and there was a semi-stampede, the pall bearers, mourners and almost every one in the church, with the exception of the priest who was conducting the obsequies, rushing out. Filled with dismay at the result of his experiment, Mr. McDede rushed out of the church onto the lawn in front to persuade those who had deserted him to come back. After several minutes of excited declamation and entreaty he managed to make a sufficiently satisfactory explanation to the panic-struck onlookers and got them to their pews. After quiet was restored the ceremony was continued and passed off without further interruption.

Foreign Automobile News.

Reports to the Department of State announce that no automobiles are manufactured in Greece, and that so far only two have been imported, both of these having gone to Athens. It is further stated that many Athenians are desirous of purchasing motor vehicles and it is expected that sales will be considerable there in the near future. Continuing its report, the department states that the unpopularity of automobiles in the Netherlands is due to the fact that the prices are considered too high by the Dutchmen. When this matter is remedied and the figures are placed within reach of the frugal Netherlanders, it is probable that a good field will be found in that country for the vehicles as the smooth, level roads are very inviting and promise pleasant, easy running.

An Electric Ranch.

A report from Detroit, Mich., says that an interesting experiment in conducting a ranch will be made this Winter in Lower California and Mexico by Michigan ranchers.

Many of the old ranching methods will be done away with and in their place strictly novel and up-to-date ideas will be put in operation. The ranch is controlled by J. D. Norton, of Pontiac, and his uncle, T. M. Flower, who has been ranching in Lower California for several years. Mr. Flower is a nephew of the late R. P. Flower, of New York, and Norton a grand-nephew.

The two ranchmen have secured control of 16,000 acres of land just across the border from the state of California. The property is 75 miles from San Diego and 30 miles from Ensenada, Mexico, the nearest town. It is situated in a valley, almost surrounded by mountains, is fertile and well watered. Large quantities of grain will be raised, 8,000 acres already having been sowed, but the main industry will be stock-raising. In addition to this the ranch will possess one of the largest poultry runs west of the Mississippi River. The most modern incubating plant will be installed for this portion of the enterprise.

The ranch will be supplied with all the conveniences possible. A unique feature of it will be the placing of several searchlights on the mountains overlooking the ranch, thus replacing the old system of night riding to prevent thieving. The tender of each light will be armed with a long-range rifle and will also be provided with a signal code by which he can flash information to the other light tenders and any one who may be out among the cattle. Each light tender will also have at hand a telephone connected with the main ranch, the pushing of the button ringing an alarm bell. All parts of the ranch will be provided with telephone stations and an electric light plant will be installed at the ranch, all of the buildings being illuminated with electricity.

FIG. 2.—INTERCOMMUNICATING DESK SET.

Telephone Desk Sets.

The accompanying illustrations show two new designs of desk sets which the makers, the Garl Electric Company, of Akron, Ohio, claim to possess many points of excellence and superiority. Fig. 1 shows a set for bridging on metallic circuit, especially adapted for long-distance lines, in which the transmitter is of the granular carbon solid back variety, the receiver of the double-pole type and all contacts and springs of German silver. This set is made up in various styles of woods, so that its base may be supplied to match the desk upon which it is to be used. They are furnished also with connecting cords and plugs and with either bridge or series ringers as desired.

FIG. 1.—LONG-DISTANCE DESK SET.

Fig. 2 shows a 10-point intercommunicating desk set of a type which is manufactured in from six to twenty points. This instrument is provided with a long braided cord and a connecting block and its general construction is similar to that of the long-distance set described above. This system of intercommunication is such that connections may be had between any two telephones and any number of pairs of telephones on the same system may converse simultaneously without interference. It is said that the plug may be left on any of the points making it thus impossible for the telephone to be put out of service accidentally.

Corporation News

ITHACA, N. Y.—W. K. Turner, D. M. Dean and H. Bergholtz have incorporated the Ithaca Electric Company for $50,000.

ALBANY, N. Y.—Certificates have been filed by the Queens Borough Electric Light and Power Company for an increase of its capital stock to $410,000.

MAXATAWNY, PA.—Kutztown and Philadelphia capitalists have recently incorporated the Keystone Light, Heat and Power Company for $15,000.

NEW CASTLE, PA.—Capitalists of this city have incorporated the Lawrence Heat, Light and Power Company with $10,000 capital stock, and operations will be begun in the near future.

CLEVELAND, OHIO—An increase of capital stock has been certified to recently in this city by the United States Telephone Company. This brings the figures to a total of $2,000,000.

NEWARK, N. J.—William A. Jones, Edward D. Conklin and Frederick P. Crane have incorporated the American Light, Power and Transportation Company, with a capital stock of $1,000,000.

HARTFORD, CT.—Certificates filed in the office of the Secretary of State show an increase of $3,500 to the capital stock of the Hartford Electric Light Company, which was incorporated for $700,000.

JERSEY CITY, N. J.—The Equitable Light, Heat and Power Company has been incorporated under the laws of the state of New Jersey with a capital stock of $50,000, and expects soon to commence operations.

BOSTON, MASS.—Local capital has recently incorporated the Electric Safety Traction Company with a capital stock of $5,000,000, its object being to build and equip electric railways in the state of Massachusetts.

CONCORD, MASS.—Boston capitalists are said to be heavily interested in the Concord & Clinton Street Railway Company, which has recently been incorporated for $60,000. The line will start in Maynard and run six and one-half miles through Acton into Concord.

JUNCTION CITY, KAS.—Local capital has incorporated the Junction City Electric Railway, Light and Ice Company with a capital stock of $100,000, to construct an electric railway from Junction City to Fort Reilly, and to operate an electric light plant in the former town.

ALBANY, N. Y.—The Dutchess County Telephone Company, whose principal offices will be at Poughkeepsie, has been incorporated principally by New York capital for $125,000, and will operate throughout Dutchess and the counties in New York immediately adjoining.

MONTPELIER, VT.—A charter has been granted to the Chittenden County Traction Company, which has been incorporated with a capital stock of $200,000. The company's purpose is the construction of an electric railway from Colchester, through six intermediate towns, to Addison.

CONCORD, N. H.—A charter has been granted to the Exeter, Portsmouth & Newmarket Street Railway Company, which was incorporated recently in this city with a capital stock of $100,000, to operate a line which will be 20 miles long. The capital involved is principally from Massachusetts.

GUADALAJARA, MEX.—An unconfirmed report to a New York daily paper states that the street railway system of Guadalajara has been sold to an American syndicate whose capital is mostly from Pittsburgh, Pa. It is further stated that the new owners purpose to equip the entire system for electric traction, and bonds to a large amount will be floated for that purpose, the General Electric Company being reported to have the contract.

PEEKSKILL, N. Y.—A $750,000 mortgage was recently filed in the office of the Register of Westchester County, N. Y., by the Peekskill Lighting and Railroad Company, the money being desired to extend the company's lines in Connecticut and the northern part of Westchester County. The mortgage is in favor of the New York Security and Trust Company and is signed by the president and treasurer of the Peekskill corporation. If the company's plans are successful another extension will be made soon from Peekskill to Sing Sing, where connections will be made with the Ossining trolley road.

AN ADJUSTABLE WRENCH.

An Adjustable Wrench.

The Elgin adjustable wrench, handled by the Western Electric Company, Chicago, is one of the handiest wrenches ever put on the market. It is easily and accurately adjusted and has an exceedingly wide range of usefulness. It will hold pipe, nipples, collars, rods and square, hexagonal or round nuts, making it almost indispensable to blacksmiths, plumbers, gas-fitters, engineers, electricians, machinists and implement men. It is nicely proportioned, well finished and fully nickel plated, made of steel with hardened jaws. It is seven inches long and weighs 10 ounces. The accompanying illustration gives one a good idea of its construction.

New York Electrical Society.

On the evening of November 16, the New York Electrical Society held its two hundred and ninth meeting at the College of the City of New York, the feature of the evening being a lecture by Mr. Charles P. Steinmetz. The subject was "Alternating-Current Engineering," and it was handled by Mr. Steinmetz in his usual masterly fashion. Beginning with the inception of the electric lighting industry in this country, the speaker carried the subject through all its various stages, ending his address with a terse and careful description of present methods. Mr. Steinmetz's work is too well known to need any comment, and the reception accorded his carefully prepared address, which was made without notes, was *prima facie* evidence of the appreciation of the members of the society, who, after he had finished, asked several questions which the lecturer answered.

Before declaring the meeting adjourned President T. C. Martin said he believed Mr. Kipling had made the statement that if Lord Roberts were stood upon his head and shaken the bullets would fall out, adding humorously that if Mr. Steinmetz were treated the same way, phases would probably fall out.

The thanks of the society were tendered to Mr. Steinmetz unanimously and in accordance with the wish of the members President Martin requested him to write out the lecture in full. When this is done the manuscript will be printed and circulated among those interested, forming another of the valuable contributions to electrical literature which have already made Mr. Steinmetz famous.

Annual Meeting of the Illinois State Electric Association.

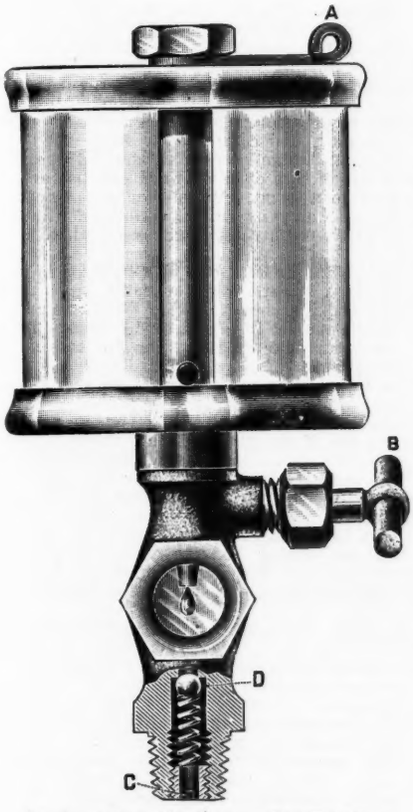
The first annual meeting of the Illinois State Electric Association will be held at the University of Illinois, November 27, 1900. The morning business session will be followed in the afternoon by an illustrated lecture on some of the most recent developments and discoveries in electricity. A tour of inspection will be made by the members of the association, including the scientific and engineering laboratories and other points of interest about the University.

The association was organized at Springfield, Ill., April 24, 1900, and represents in its membership the leading electric light and power industries doing commercial business throughout the state.

Charles A. Chapin, of Benton Harbor, Mich., has purchased the Buchanan dam and electric light plant and expects to transmit power throughout Berrien County to South Bend and other cities.

An Automatic Oiler for Gas Engines.

The proper lubrication of the cylinder and piston of a gas or oil engine in which the average temperature during inflammation is not far from 2,000 degrees Fahrenheit, is one of the essential conditions of successful operation. In order to obtain the best results, a constant feed commensurate with the piston speed is absolutely necessary, as too much oil will cause smoke and too little a cutting of the cylinder or piston. Then, with a variable speed, as in automobile engines, the amount of oil should be in proportion to the revolutions and should stop when the engine stops, and to attain such results, the feed must depend on some factor of the speed such as the induction strokes of the engine.



An Automatic Oiler for Gas Engines.

The engraving herewith illustrates an oiler which has many excellent features. This oiler was designed especially for lubricating the cylinders of gas or oil engines, vacuum pumps or air compressors in which the pressure during the induction stroke is slightly below atmospheric pressure, which is always true of such machines, for if the pressure within were not less than without, the cylinders would never fill. The essential features are a glass reservoir which is filled through a hole in the top normally covered by the slide A; B, a needle valve which adjusts the feed into the air-tight bull's-eye, as shown, and D, a check valve held to its seat by a spring, the compression of which is adjusted by the nut C, which can be turned with a screw-driver.

While this is essentially a cylinder oiler, by removing all compression from the spring, it may be used in place of the ordinary sight feed oiler on any part of the engine. When this oiler is used for admitting oil to the cylinder of a gas engine or air compressor the check valve spring is so adjusted that the valve seats when the air pressure above and below the check is the same, but if the air pressure below the check valve is rarefied or slightly reduced, the check will open and allow the air in the bull's-eye enclosure to pass into the cylinder, whereupon the atmospheric pressure on the oil in the reservoir will force it down through the needle valve to the bull's-eye chamber from which it will pass into the cylinder every time the check valve opens. When the engine stops, rarefaction in the cylinder ceases, the check valve remains seated and the oil stops feeding through the needle valve, because oil can not drop into the bull's-eye chamber if air and oil are not drawn out. When compression begins in the cylinder, the check valve shuts and no smoke or pressure from the explosion passes into the bull's-eye chamber or reservoir.

The reservoir can be filled while the engine is stopped or running without opening or closing a valve or changing the adjustment of feed. The quantity of oil is always in sight; the amount feeding can always be seen; the oiler stops with the engine and begins when the engine is started again, and as no pressure accumulates in the glass reservoir, there is no danger of the oil cup exploding. This oiler is the invention of Mr. C. E. Sargent and is manufactured in several sizes by the Michigan Lubricator Company, 274 Beaubien street, Detroit, Michigan.

A bitter rate-war is being fought between the Toledo, Ohio, Fremont & Norwalk electric line on the one hand, and the Wheeling & Lake Erie steam road on the other. The latter has had almost a monopoly of the local traffic between Fremont and Toledo for some time. It has just announced a sweeping reduction of fares and now sells commutation tickets at one and a quarter cents per mile. These are good between Toledo, Fremont, Bellvue, Clyde, Monroeville and Norwalk. The Lake Shore road, which also parallels the electric, has not taken any hand in the fight as yet.

New Submarine Boats for the Navy Department.

A contract has been awarded by the United States Government, Navy Department, to the Electric Boat Company, of Long Island, according to reports received from Washington, for six new submarine torpedo boats of practically the same pattern as the now justly famous Holland. This will, to a certain extent, put us on the same plane as France, which was practically the first country of importance to investigate the claims of submarine boat inventors, and which now has several boats of that class in her torpedo flotilla.

In connection with the building of the new crafts the Electric Boat Company is said to have contracted with a firm in New Suffolk, L. I., for a site where it will establish a breakwater and basin for testing the boats. Half an acre of new land will be obtained by dredging in front of the breakwater and throwing the sand thus obtained up back of it. Upon this foundation a frame machine shop and large engine house will be erected, about 50 men being employed in both buildings. It is expected that the boats will be begun as early in the year as it is possible to get the plant in operation, this being this first and most important order the company has received.

Additional reports from Newark, N. J., state that Mr. Holland has planned a number of voyages running from 1,000 to 4,000 miles, including a trip to Cuba and another one to Europe. As a precaution a tender carrying extra men and duplicate parts of the machinery will accompany the boats. A full crew of seven men will man each craft. It is the intention of the Holland people to prove that the new boats are not uncomfortable in a heavy sea. The boats will be tested in rough weather, and the month of March has been selected for the trials, as that is about the time when the heaviest weather and roughest seas are encountered on the Atlantic. The first long trip will be over the southern route, the first stop of the voyage being made at Hamilton, Bermuda, and the next at Lisbon, Portugal.

The Western Ohio Electric Railway Company has decided to build its power house and car barns at St. Mary's, directly on the line of the new electric railway which will run between Lima and Minster, Ohio. The board of trade of St. Mary's has purchased a three-acre tract of land in the southern part of the city for the company, and in addition will give the company several hundred dollars to pay certain other expenses. The work on the buildings will begin at once.

Industrial Notes

THE NORTHERN PACIFIC RAILROAD COMPANY will build new shops at Brainerd, Minn., the steel work of which will be furnished by the American Bridge Company.

THE HARDY LAMP COMPANY, Pittsfield, Mass., makes the interesting announcement that for over 10 months it has not received a serious complaint regarding its shipment.

THE NON-POLARIZING DRY BATTERY COMPANY, 625 Broadway, New York, is making a new size of the "O. K." cell of the following dimensions: Seven and seven-eighths by five and eleven-sixteenths by two and eleven-sixteenths inches.

JOHN T. McROY, Chicago, Ill., has issued a neat calendar-blotter, setting forth the advantages of his vitrified clay conduits in a simple, effective manner. In the centre of the blotter is James Whitcomb Riley's poem "Jest Do Your Best."

WILLIAM ROCHE, 42 Vesey street, New York, reports excellent success with the "Autogas" dry battery for automobiles, gas and gasoline engines and special portable ignition work. These batteries are furnished in sets of four compactly put together for this portable service.

THE ELECTRIC APPLIANCE COMPANY, Chicago, states that its sales of Packard lamps during the past year are nearly double that of any previous year. This record has been made in the face of the fact that the conditions of sale of incandescent lamps are more severe than ever before.

THE HOMER COMMUTATOR COMPANY, Cleveland, Ohio, is soon to occupy an entire new building which is now being completed. This company does all kinds of commutator work, rewinds armatures and manufactures gears, pinions, bearings, motor brushes, trolley wheels and mica rings.

THE CROWN WOVEN WIRE BRUSH COMPANY, of Salem, Mass., informs the ELECTRICAL REVIEW that its exhibit of brushes at the recent Paris Exposition received the only mention of any there shown, and that its product was awarded the highest place by the international jury.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has published its bulletins, Nos. 3022, 3023 and 3024, setting forth the advantages of electric pumps for deep wells, sewing machine electric motors and electric coffee mills, giving complete data and full price lists, with discounts.

JOHN A. HAMBLIN, Providence, R. I., is placing before the electric lighting field a well designed series of arc lamps, known as the Stellarc, for 110-volt and 220-volt circuits, and also a series of enclosed arc lamps for constant current. He has recently issued a new bulletin descriptive of the new lamps and will be glad to send it upon request.

THE CENTURY TELEPHONE AND CONSTRUCTION COMPANY, Cleveland, Ohio, has recently prepared a descriptive circular of the "Can't Pack" transmitter. This transmitter was described in the columns of this journal a short time ago. The company has also issued a very comprehensive catalogue showing the telephones, switchboards and accessories which it is now manufacturing.

THE HELIOS-UPTON COMPANY, Philadelphia, Chicago and Peabody, Mass., is manufacturing a type of the Helios-Upton arc lamp for enclosed-current service. These lamps burn on any frequency 7,200 to 16,000 alternations. It is claimed that they trim with facility and operate with one cored and one solid carbon, insuring the smallest carbon consumption as well as the largest amount of light and illumination.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., is now well established in its fine new building, which is one of the largest and most complete supply houses in the country, and has just entered its third order with the Burt Manufacturing Company, of Akron, Ohio, for Cross oil filters for use in their works. This company publishes a catalogue devoted exclusively to electric railway supplies.

THE SPRAGUE ELECTRIC COMPANY, of New York, has secured the contract for ventilating the new Grand Central Depot, and will install fans ranging from 18 to 60 inches in diameter, which will be operated by Lundell motors. This company has also been so successful in introducing its products in foreign markets that the Societè Française Sprague has been formed with offices in the Rue de Madrid, Paris.

THE LEA-HOOVEN MANUFACTURING COMPANY, Anderson, Ind., claims the following features as being incorporated in the new types of L.-H. enclosed arc lamps: A 10-inch globe using full-sized carbon, the system of resistance so constructed as to eliminate possible short circuit, accessibility to working parts, fewness and interchangeability of these working parts. The company wishes to announce that it will be pleased to send its new catalogue on request.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY, Chicago, has secured the contract to furnish the Corsicana, Tex., Telephone Company with a 1,200-capacity, central-battery telephone equipment. The Western Company claims to have sold more multiple central-battery equipments during the past six months than any other manufacturer. Owing to greatly increased business, this company has been obliged to increase its factory floor space 10,000 square feet.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, is having great success in the introduction of its new lines of protected type of direct-current motors. These motors are made in sizes from one-quarter kilowatt to 10 kilowatts. This company now carries a complete stock of motors and electric fan apparatus at its New York sales office, 136 Liberty street. Mr. W. B. Van de Water, who is well known in the electrical field, is general sales manager of the eastern district for this company.

THE SIEGRIST LUBRICATOR COMPANY, St. Louis, Mo., manufacturer of the Siegrist automatic oiling system, is meeting with considerable success in the introduction of this apparatus. Its shops are running to full capacity and its equipment is now being installed in a number of representative railway and power plants. Among some of the prominent railroads using this equipment for lubricating are the Metropolitan East Side Elevated Railway Company, of Chicago; the United Railway Company, St. Louis; St. Joseph Railway, Light, Heat and Power Company, St. Joseph, Mo.

THE EUREKA ELECTRIC COMPANY, Chicago, is now distributing its "20th Century" catalogues. The company believes this catalogue to be one of the handsomest, as well as the largest and most complete telephone catalogues ever issued. It is certainly a work of art, and should be in the hands of every telephone company interested in telephones, switchboards, cable heads, protectors and other lines of apparatus. The company will be pleased to forward a copy gratis to any company desiring one. It contains valuable information outside of describing the large line of Eureka apparatus.

THE IMPROVED PRIMARY BATTERY COMPANY, 594 Broadway, New York, has recently received a letter from the fire department of New York, which has been using 25 of the Baines' cells. The following statement occurs in the letter: "They have shown a very appreciable economy in this short time as to expenditure of materials; recovery of copper; and an increase in the general efficiency of the cell which seems to be due to a lessening of the internal resistance. I have not given them a test with instruments, owing to a lack of time, but a comparison with other cells without this grid shows that there is a slight decrease in the consumption of copper sulphate through diminution of local action."

THE AMERICAN BRIDGE COMPANY has just closed a contract with the North German Lloyd Steamship Company, calling for the erection of two steel buildings on the banks of the River Wesser, at Bremen, Germany. The machine shop building will be 100 feet in width and 300 feet in length, two stories in height. The foundry building is 75 feet in width and about 600 feet in length. Both buildings are designed after the best American practice. The contract has been secured by the American Bridge Company in competition with the best German bridge shops, and shows the extent to which this class of work can be carried. This is a great triumph for the American Bridge Company which, doubtless, will lead to further contracts of the same kind.

JAMES S. BARRON & COMPANY, 24-30 Madison street, New York city, are attracting considerable attention with their new patent enamel insulated bridle rings. These rings are manufactured for the convenient installation of wire and are unique in the fact that it is not necessary to remove the ring when the wire is to be removed. They are made with an overlapped opening at the top of the ring, which permits wire of any size to be removed without destroying the usefulness of the ring or damaging the wire in any way. The ring is so manufactured as to prevent the likelihood of any wire becoming unloosed from it by its own actions. Being heavily coated with glass enamel they are perfectly suited for outdoor insulation and to resist the weather.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, has been awarded the contract for a 1,500-line multiple switchboard by the Johnstown Telephone Company, Johnstown, Pa. This board is to be equipped with the lamp double supervisory system and self-restoring drop line signals, operating on the central-battery system. Among other smaller contracts recently received by this company are those at Elmore, Ohio, 100 lines; Woodville, Ohio, 100 lines; Huron, Ohio, 100 lines; Waupaca, Wis., 150 lines; Thomas, W. Va., 50 lines, and Sapulpa, I. T., 100 lines. These exchanges will be equipped with the Kellogg "Express" 150-line switchboard. Bloomfield, Ind., will use a small-size special "Universal" switchboard, having a capacity of 400 lines.

THE OFFICIALS of the National Automobile and Sportsman's Exhibition, to be held in Washington, D. C., during the week of December 10, are busily engaged in the work of perfecting the details of the affair, and there is every indication of an interesting and successful exhibition. In point of uniqueness and attractiveness it is expected to eclipse every trade exhibition that has been held at the National Capital. In addition to the usual exposition features, there will be a number of competitions during the week, in which the public will doubtless find amusement. An eight-lap track will be constructed within the hall for this purpose. Washington is an inviting field for the sale of automobiles, and the forthcoming show should serve the purpose of greatly stimulating public interest in the subject.